AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly

Volume 93 — September 15, 1945 — Number 6

CONTENTS

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AUTOMOTIVE *and* AVIATION INDUSTRIES is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by
CHILTON COMPANY (INC.)
Executive Offices
Chestnut and 56th Streets, Philadelphia 39, Pa., U.S.A.

AUTOMOTIVE *and* AVIATION INDUSTRIES. Vol. 93, No. 6. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, $1.00 per year. Canadian and Foreign $2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 15th), 50 cents.

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AUTOMOTIVE and AVIATION INDUSTRIES

Published on the first and 15th of the month

September 15, 1945
Volume 93, No. 6

The Effects of Taxation

By Harley L. Lutz
Professor of Public Finance, Princeton University

THE doctrine that taxing, spending and borrowing should be used to influence the economy rather than to promote the prudent management of the government is a product of recent theories about fiscal policy. The purpose of fiscal policy, according to this view, is said to be the maintenance of national income and employment; but in reality it is the maintenance of a steady and continuous inflation which the devotees of the planned economy so often mistake for prosperity.

Under our economic system prosperity grows from conditions which encourage and reward individual initiative and the investment of earnings in job-creating enterprise. Excessive taxation has a deleterious effect on both of these prime essentials. It acts as a damper on pecuniary ambition and discourages the risking of capital.

Economic effort is inspired, in some degree, by non-pecuniary motivation, yet by and large the economic motive is dominant. Most people exert themselves more if the prospective reward is greater in tangible economic terms, that is, in profit or wages or some other form of income. Taxation reduces these rewards. It imposes on us a kind of compulsory altruism, whereby we spend a part of our time in working for others. When one is compelled to spend more of his time or to devote more of the fruits of his ability to this kind of altruism than he feels is proper, his normal corrective procedure is to obtain relief by doing less. This is, for the individual, a more speedy and more effective remedy for excessive taxation than to undertake, through group action, to secure those economies of government which would reduce the tax levies. Such reaction is more likely to occur under the ordinary routine conditions of peace than it is under the stress of some great national emergency such as war.

The injurious effects of taxation on individual motivation occur at points where they are least likely to be readily perceived, although at the same time they are most likely to cause maximum damage. Most of us must learn to adjust our necks to the tax yoke, be it heavy or light. We have neither the opportunity nor responsibility for making decisions on which the jobs and the well-being of others depend. Among all of the economic decisions, none is more significant for the general well-being than the decision whether or not to save and invest, to risk capital, to venture into a line of business where great rewards or great losses may lie ahead. In short, the greatest damage of severe taxation is done by tax rates and tax methods which impair the vigorous functioning of the enterprise system. The chief concern of legislators and of tax students should be with the effect of taxation on enterprise, rather than with such esoteric matters as its effect on inflation or deflation or on the price level.

—Abstracted from an article in The Tax Review, Copyright 1945 by Tax Foundation.

The Current Situation

in the Aircraft Industry

THE termination of Government aircraft procurement contracts following V-J Day was drastic as had been expected to take place at the end of combat warfare with Japan. Overnight America's aircraft industry fell from its wartime position—the biggest business in the entire world—to around 15th or 16th in value of product output in the nation.

Reduction in Army aircraft production schedules has been in effect since early in 1944 when the original 1944 program was cut back by 30,400 airplanes at an estimated figure of $4,850,000,000. The second reduction of $700,000,000 came in the program for the first quarter of 1945, lowering the total by 1500 airplanes. In April, prior to V-E Day and again in May following V-E Day, the program was further reduced 43,800 airplanes, this cutback amounting to approximately $7,600,000,000.

The remaining contracts on V-J Day were cancelled 90 per cent based on the 1945 program and 94 per cent based on the 1946 program and included 31,000 airplanes. This cancellation totals approximately $7,000,000,000.

Thus, since the start of 1944 the over-all military aircraft production program has been reduced a total of 106,700 airplanes at a saving of $20,150,000,000. The remaining Army aircraft contracts are research and development commitments and approximately $175,000,000 in production contracts which will taper until their completion shortly after Jan. 1, 1946.

The Navy procurement picture is substantially the same with approximately $4,600,000,000 worth of aeronautical equipment contracts cancelled on V-J Day. This left $1,134,000,000 worth of production and development contracts for aircraft on hand. The production schedules, as with the Army, call for tapering to completion around Jan. 1, 1946.

Present estimates are that a total of 700,000 persons was at work on V-J Day in the airframe prime contractors' plants and a total of 1,100,000 in the entire industry, including subcontractors. A survey reveals that present plans call for the reduction of this payroll already under way, to approximately 200,000 by December of this year. On the basis of present estimates, it will shrink further to around 150,000 by the middle of next year.

The commercial backlog of the industry is in an extremely fluid state with most of the contracts of recent months being "open at both ends" and the contingencies provided for "at both ends" seem to be taking place. A very important part of these commercial backlogs are tied up with the surplus aircraft disposal picture, which itself has been confused as a result of the move to appoint a single surplus administrator to replace the present three-man board.

The airlines are interested in the surplus equipment insofar as this source may provide transport planes at less cost than new ones, particularly in the four-engined category, now in high demand. Experience in the past with twin-engined transport planes reveals that reconversion of the military models to highly stylized airline models requires some 15,000 manhours whereas new ones may be built for only 10,000 manhours. In the four-engined category, however, ths situation is not necessarily true.

Another problem in the execution of commercial contracts is the necessity for using Government-owned tools, equipment and facilities for their production. The Surplus Property Board is legally bound to receive the highest possible return on the sale or lease of this material whereas the industry, obviously, is interested in obtaining it at the lowest possible price. Present arrangements call for the listing of all Government-owned equipment in a plant and the posting of this for sale to the lowest bidder. This presents the possibility that "outsiders," including scrap dealers, might purchase these tools, jigs and fixtures. It is probable, however, that the highly specialized nature of this equipment will leave the way open for the parent company to submit the accepted bid.

Some segments of the industry are presenting plans for the lease of Government-owned material and two arrangements have been suggested — that leases be signed on a rental basis, or that leases be arranged on

(*Turn to page* 102, *please*)

International Harvester's Production Experience with

Elliptoid Shaving of

FOLLOWING years of experimentation and production experience with "Elliptoid" (also known as crown) shaving of gear teeth, the International Harvester Co. at its Fort Wayne Works has adopted the Red Ring method as the standard procedure for the finishing of transmission gears. Initial experimental work was begun about 1939 and before the end of 1940 the first gears to be elliptoid-shaved in regular production were the low speed pair in one model of the International line of transmissions. The process was employed with unusual success on certain gears for military vehicle transmissions and subsequently was used exclusively on all transmission gear sets.

In keeping with company policy on such developments, before this principle was formally adopted it was thoroughly studied by the factory management, by production engineering, by the metallurgical department, and finally was given approval by the truck engineering department. Rigid tests on the transmission dynamometers at Fort Wayne, supplemented by field experience, have proved conclusively that elliptoid shaving provides superior performance characteristics and durability exceeding previous practice. Stated briefly, elliptoid shaving provides the following advantages:

1. Reduction of noise level (quiet running transmission).
2. Elimination of end bearing concentration, thereby increasing durability.
3. Freedom from errors incident to heat treatment distortion and minute mis-alignment.
4. Improved and unvarying contact areas.
5. Reduces rejections to a minimum.
6. Aids on producing over-all production economy.

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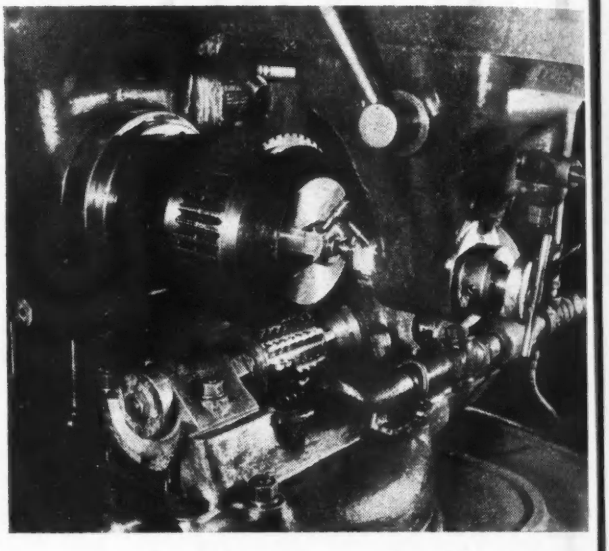
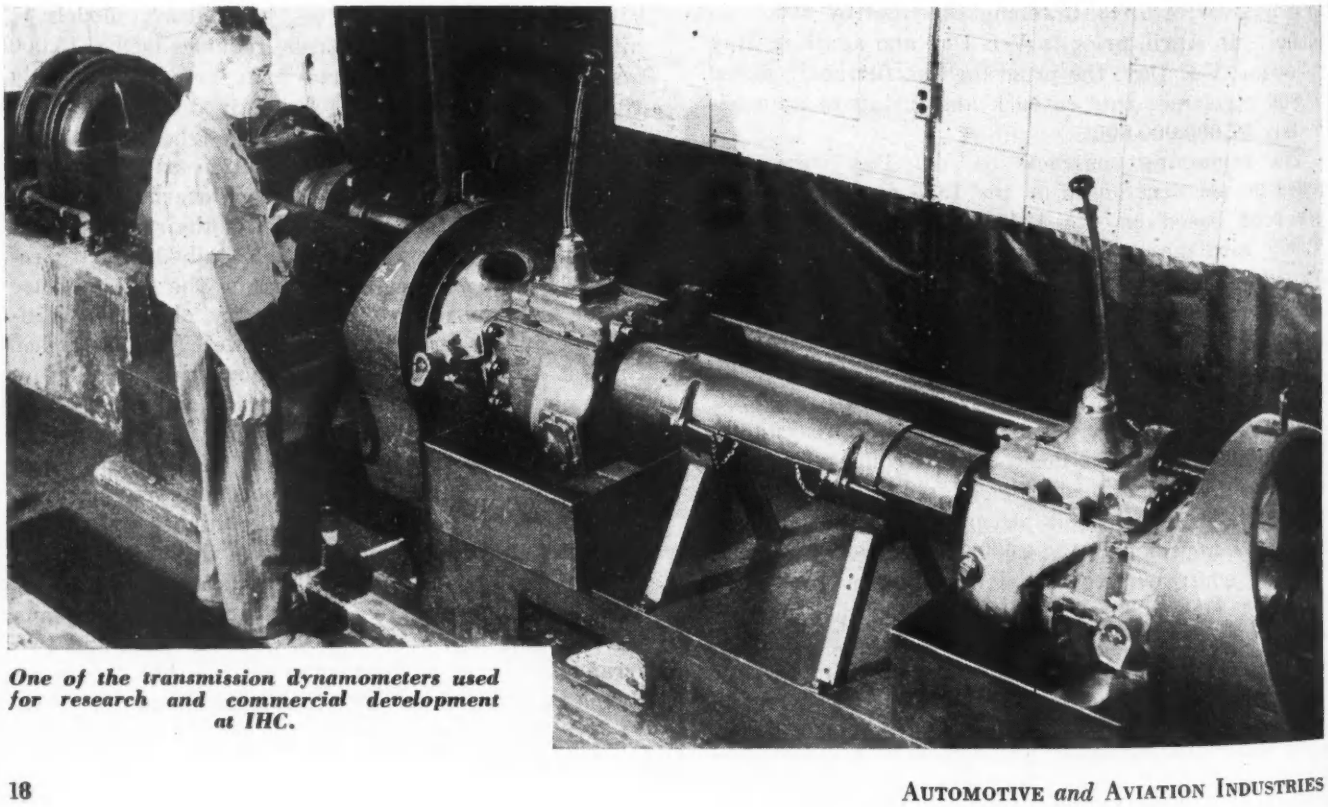
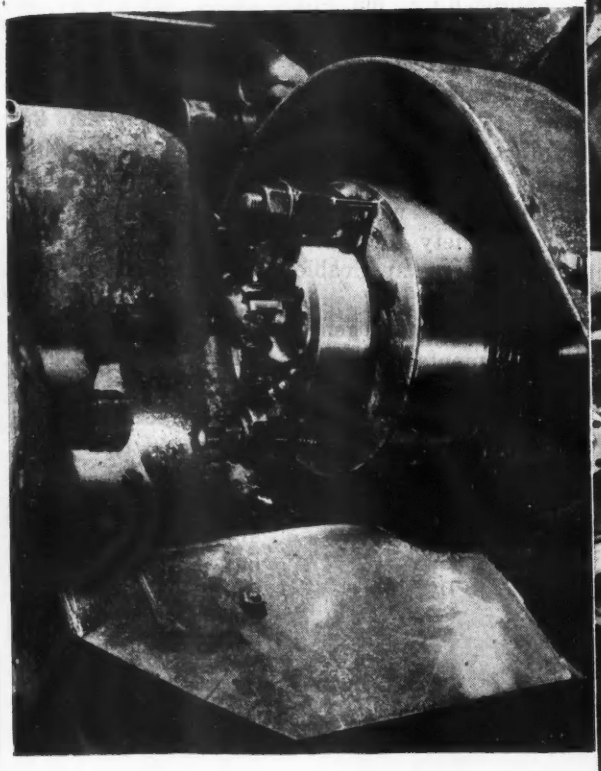


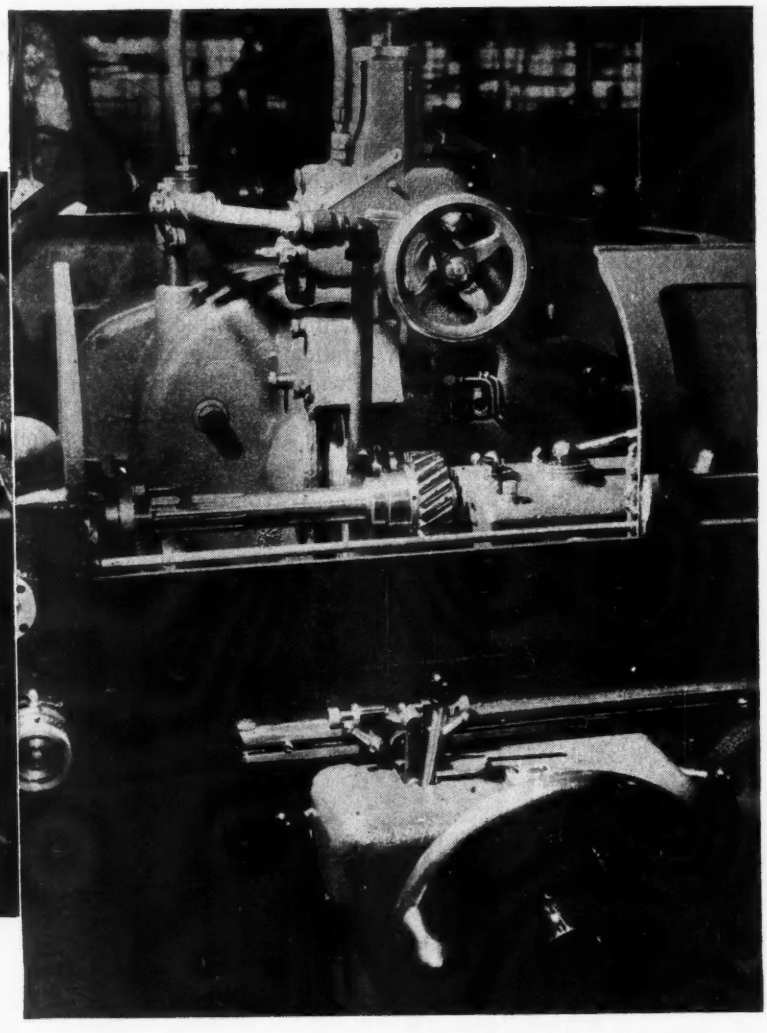
Close-up of work table of a new Barber-Colman hobber on one of the transmission gears.



One of the transmission dynamometers used for research and commercial development at IHC.



Close-up of a Fellows gear shaper in the transmission plant.

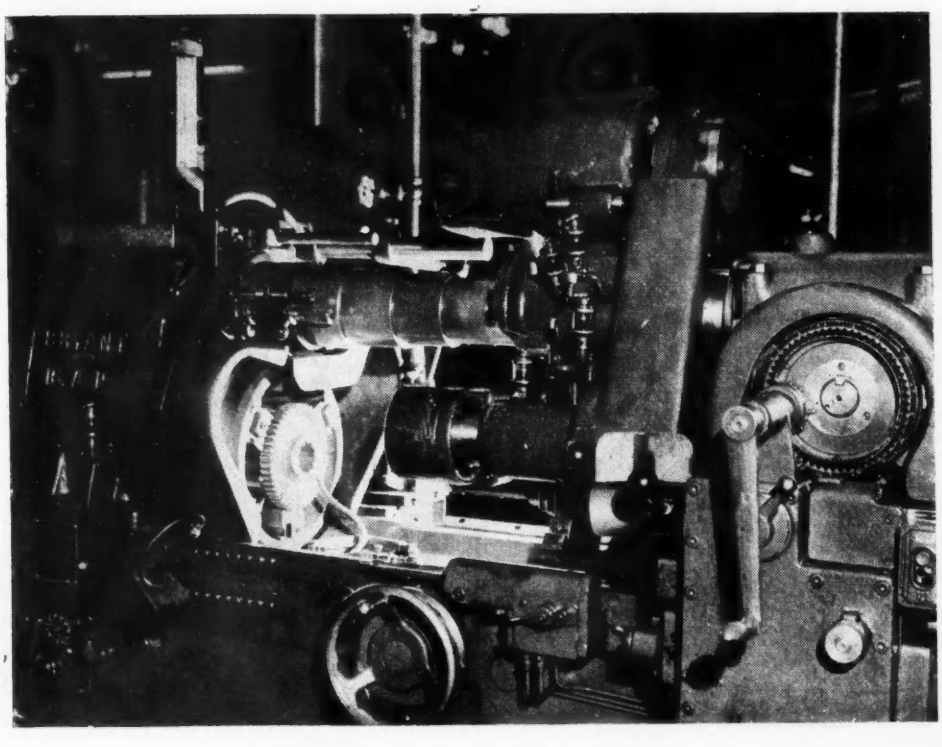


Thread grinding is done on this Sheffield precision grinder.

Gear Teeth

By
Hugo A. Weissbrodt

Works Manager,
Fort Wayne (Indiana) Works
International Harvester Co.



An example of modernity is this Bryant internal grinder used for many jobs, including the grinding of the first speed gear.

It may be of interest to touch upon the problems found in the design and manufacture of transmissions for heavy duty vehicles so as to emphasize the role of this process. The range of models and gross vehicle weight must be considerable if the truck producer is to serve the needs of his field. This makes it difficult to concentrate upon the production of a single transmission since a unit capable of meeting the torque output of the largest engine in the line would be too heavy and too costly for lighter models. Nevertheless, before research had demonstrated that failures on certain heavy duty applications were due entirely to the concentration of loading on the ends of the gear teeth because of elasticity of the gear train under overload conditions, even the most massive unit could not resist the effects of fatigue failure.

The elimination of end load concentration now possible with elliptoid shaving, coupled with advanced mechanical design and other advanced production practices, has made it perfectly feasible to build relatively light and compact transmissions capable of giving exceptionally long life under the most gruelling operating conditions. This makes it possible to reduce the number of transmissions required for the entire line, thus approaching mass-production conditions and thereby improving overall economy.

It is only in recent years that the role of fatigue has been clearly understood. Perhaps the best summation of the problem was given by J. O. Almen, General Motors Research Laboratories, in a paper entitled, "Fatigue of Metals as Influenced by Design and Internal Stresses" which was presented before the American Society for Metals several years ago. The following excerpts applicable to transmission gears are quoted below:

"Perhaps the most generally misunderstood of all machine elements are the several classifications of gears. As ordinarily designed there is only one thing certain about gears and that is that they will not function as intended by the designer. When laying out a set of gears on the drafting board the mating gear teeth are represented by parallel lines but no matter how carefully the gears are cut and heat treated the mating teeth will never again be parallel except by accident and then only through a small load range.

"The nature of the contact between two mating gear teeth is influenced

(a) by the elastic characteristics of the housing in which they are contained.

(b) by the elastic characteristics of bearings by which they are supported.

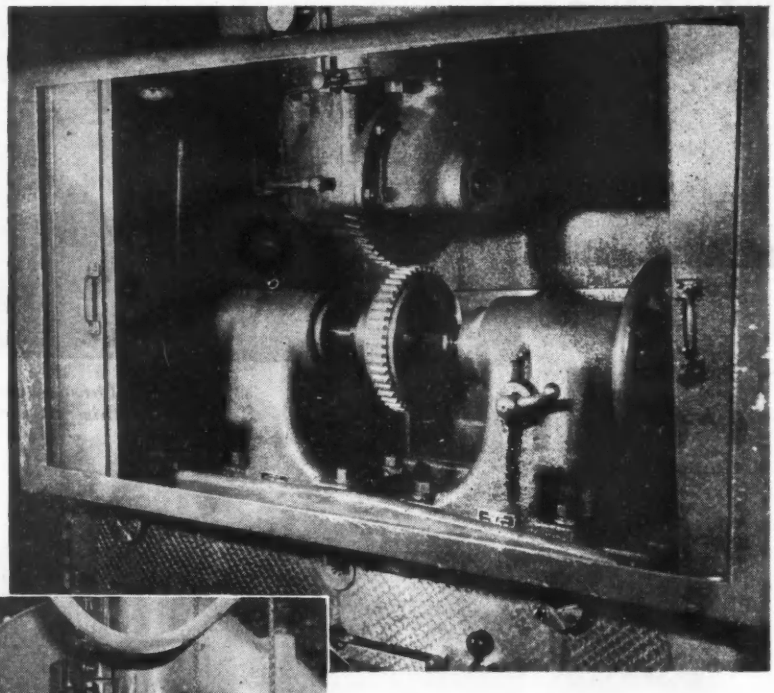
(c) by the elastic characteristics of the shafts upon which they are mounted.

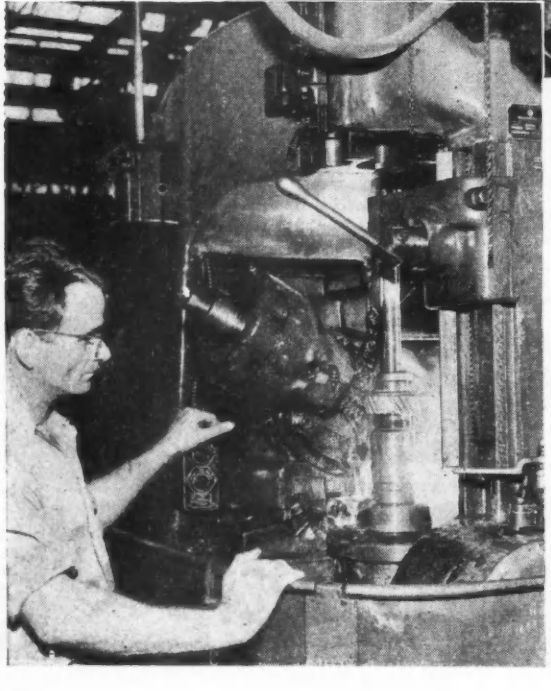
(d) by the elastic characteristics of the gears themselves.

(e) by the accumulated dimensional errors in all the supporting parts as well as the errors in the cutting of the gears.

(f) by the necessary and accidental clearances in the supporting parts.

"The result of all this is that it is virtually impossible that the parallelism between mating teeth as visioned by the designer can exist in practice. If it should chance that two mating gear teeth are parallel at some load they cannot be parallel at any other load because the elastic deflections of some of the supporting parts are not linear with respect to the load.





(Above) View of 18-in. Red Ring gear shaver (with front cover off) to show method of elliptoid shaving

(Left) Close-up of one of a battery of Cleveland hobbing machines in the transmission department.

As ordinarily designed the load on gear teeth is never uniformly distributed over the length of the teeth but is always concentrated toward one end of the teeth. Load localization cannot often be seen by examination of a gear that has been in service because, usually, each tooth of each gear makes the contact with all of the teeth in the mating gear and, therefore, the summation of all contacts under load conditions will be seen by the examiner.

"All gear teeth should be designed to afford a degree of tolerance for deflections, machining errors and warpage as has long been standard practice in spiral bevel, hypoid and in some spur and helical gears. This is accomplished by curving the teeth in such manner as to concentrate the load near the centerline of the gear width and thus avoid load concentration at the weaker extreme ends of the teeth."

Mr. Almen also points out in a specific example that the gear tooth could have been made one-fifth of the original width if load concentrations had been eliminated by proper mechanical design.

It is now recognized that by careful attention to mechanical detail to prevent stress concentration, by proper proportioning of gear sections to reduce heat treat distortion, by advanced methods of heat treatment and quenching, and by the use of elliptoid shaving to eliminate the effects of end concentrations, it is a practical matter to build relatively light and compact transmissions perfectly capable of withstanding the most severe operating conditions encountered in heavy duty service. Naturally there are no short cuts to this end. Modern production methods make possible a perfection of dimensional tolerances and surface finishes which are carefully controlled at every step. This assures the manufacture of quality gears and shafts and the alignment of shaft centers in the gear box. Nevertheless no matter how carefully the process is carried out, there are normal variations in tolerances, there is a certain amount of uncontrollable heat treat distortion, and always there is a hazard of

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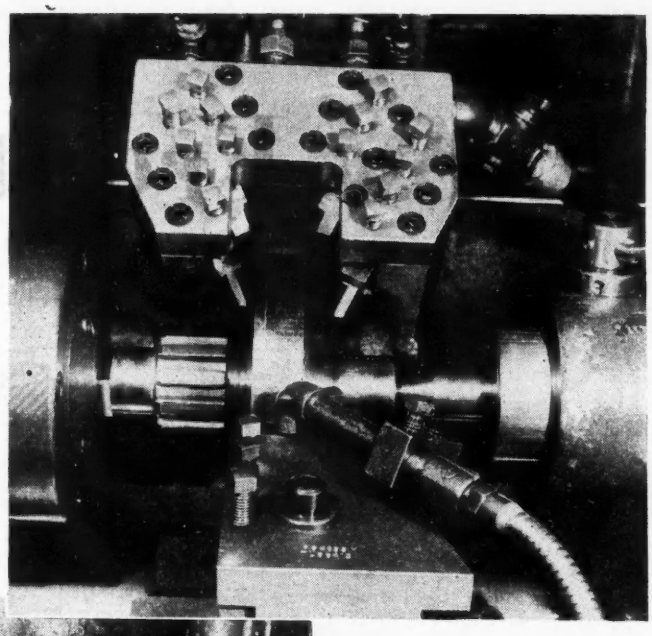
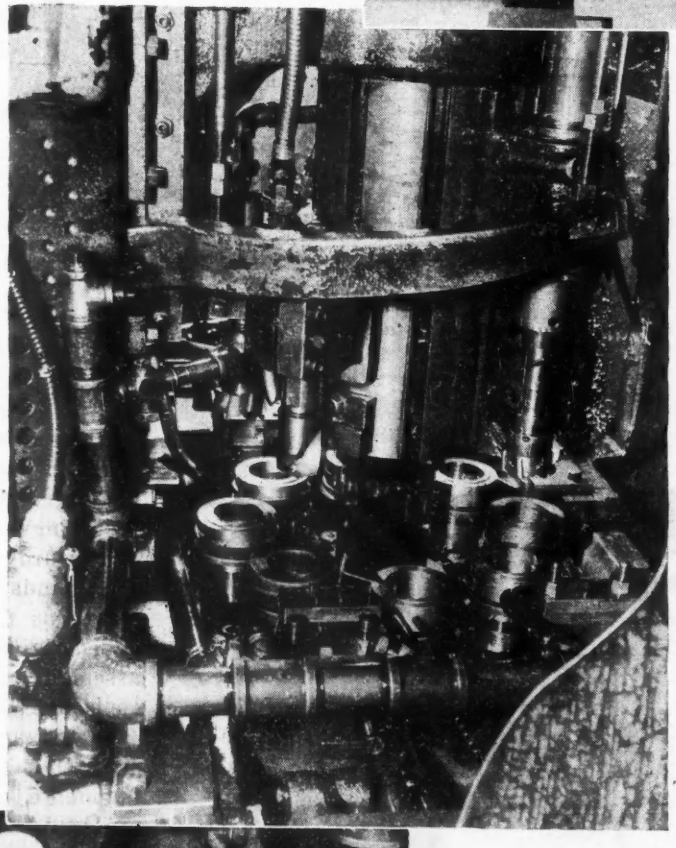
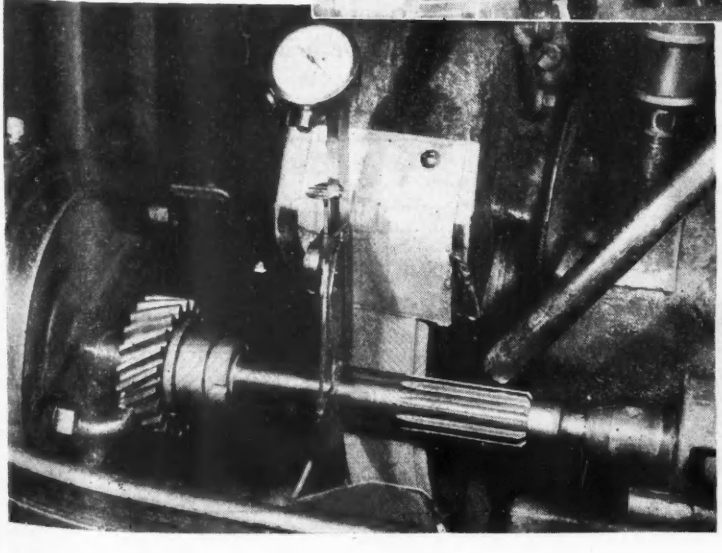


(Above) Detail of the tooling on a Fay automatic for turning the first speed gear.

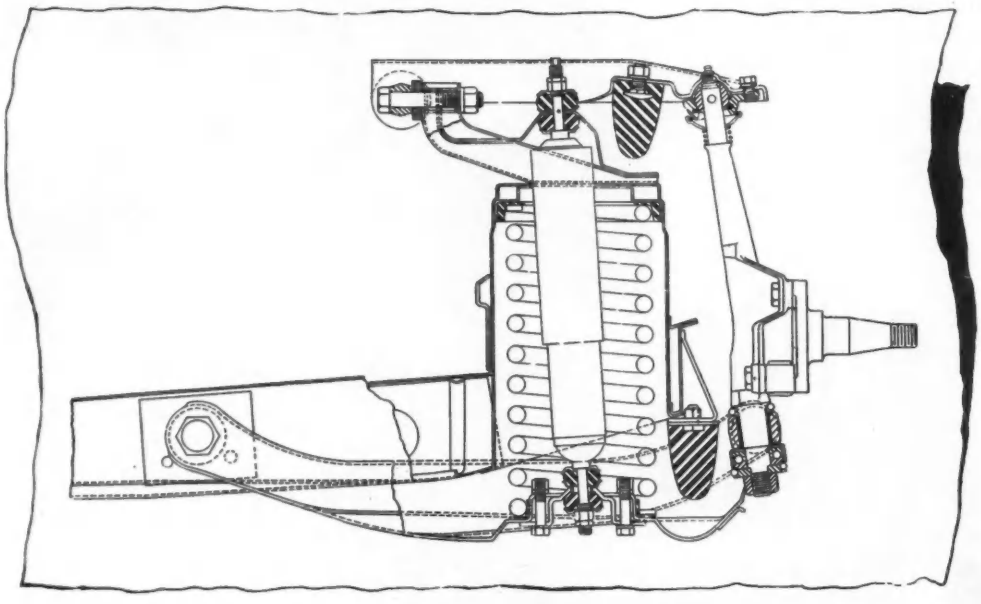


(Center) One of the big Conomatics used for turning gear blanks and other transmission parts.



One of a battery of Norton cylindrical grinders set up for grinding a clutch shaft.

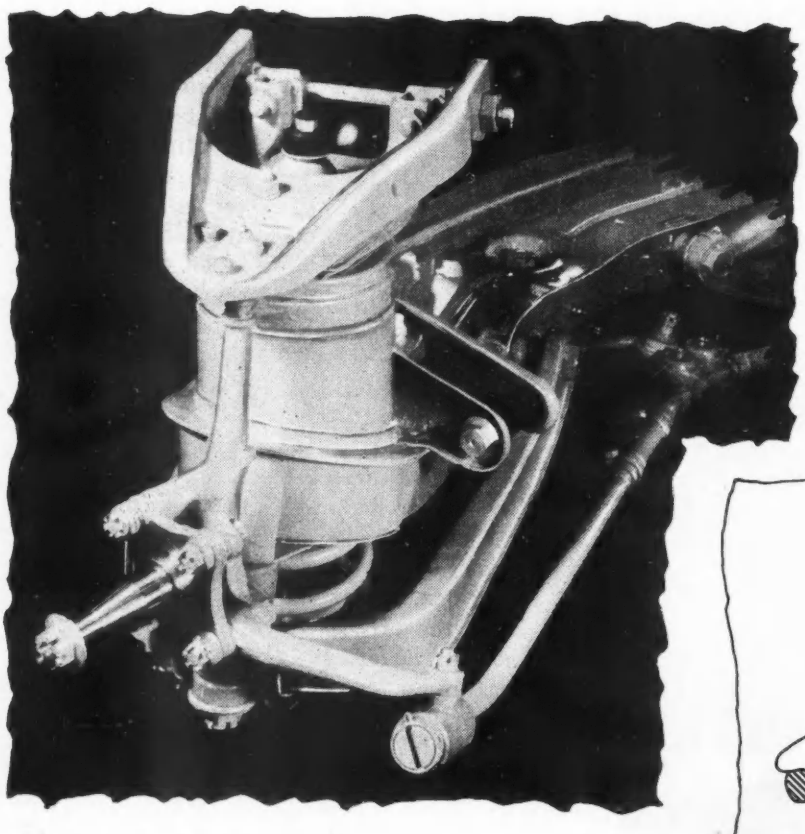
New Front Suspension S

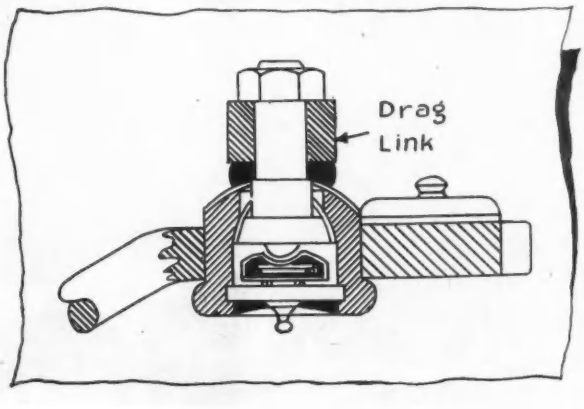


Detailed drawing of the new front suspension system used in the Nash "600" line.

SUPPLEMENTING the preliminary announcement of the Nash "600" and Ambassador Six, the Nash-Kelvinator Corp. now releases the details of the mechanical improvements incorporated in the 1946 models. Major changes on the "600" is the adoption of parallel arm-type front wheel suspension (Fig. 1), similar to the design used on the Ambassador, to replace the special form of independent suspension formerly employed. The coil spring suspension at the rear is continued without change. Taking advantage of the "Unitized" body construction on the "600," the front suspension is treated as a self-contained sub-assembly which is attached directly to the body structure by four rubber-encased fastenings. The front suspension bed —a sturdy box-like member—forms the foundation for the assembly and serves as front cross member to give added rigidity to the body. The entire assembly can be readily removed for replacement or repair.

In the spring element of the suspension, the direct-acting shock absorber is mounted within the spring. The king pin is used as the connection between the upper and lower supporting arms,





System

on Nash 600 is Self Contained Sub-Assembly

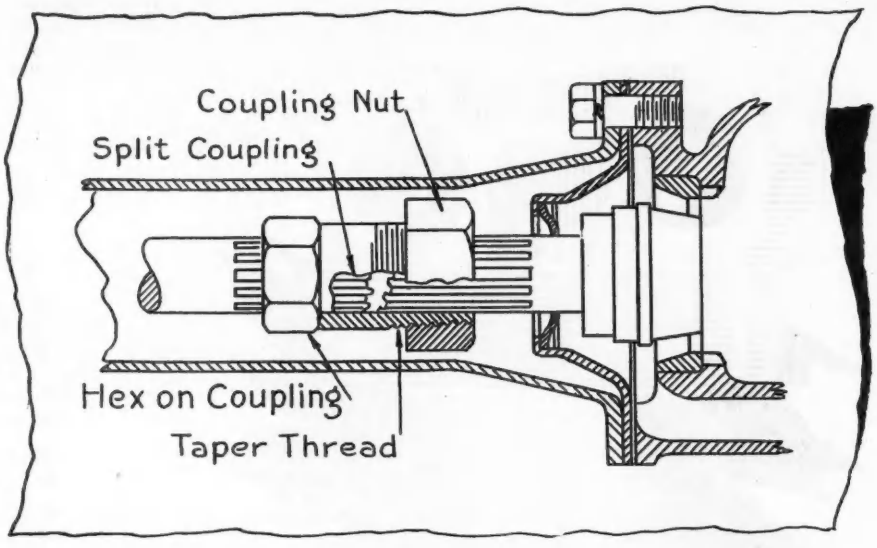


Fig. 2—Improved propeller shaft coupling at rear axle.

thus eliminating considerable upsprung weight. The top and bottom bearing points of the king pin are much farther apart than is conventional practice, thus reducing the load on these bearings and maintaining wheel alignment longer. With the new design the former tie-bars over the engine have been eliminated and cylinder heads can be removed without interference.

On the Ambassador front suspension the inner lower arm bearings now are of threaded type, sealed and lubricated, replacing the rubber bushings formerly used. The rear leaf spring rate has been lowered from 120 to 105 lb per in.

Engines on both the "600" and Ambassador have received considerable attention by way of refinement of constructional detail, offering increased output and better performance. The "600" is L-head, 6-cyl, 3.125 in. bore by 3.750 in. stroke, 172.6 cu in. displacement, rated 82 hp at 3800 rpm. (In 1942 it was rated 75 hp at 3600 rpm.) The engine has a new combustion chamber form; intake and manifolds and valve passages have been modified to improve distribution of mixture to the cylinders. Intake valves are 0.125 in. larger in diameter to afford better breathing.

The carburetor is of triple-venturi type, similar to that on the Ambassador. An automatic manifold liquid drain has been added to prevent flooding in cold weather. It consists of a check valve in the drain line, normally closed by vacuum while the engine is running, but open when the engine stops. The tube drains liquid directly to the ground.

The upper half of the connecting rod bearings is

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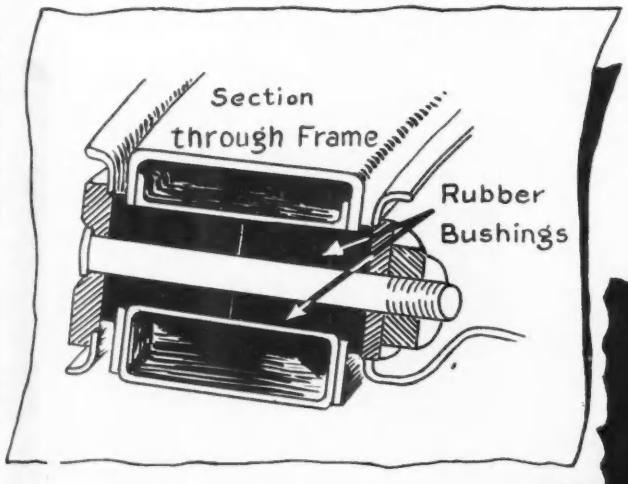
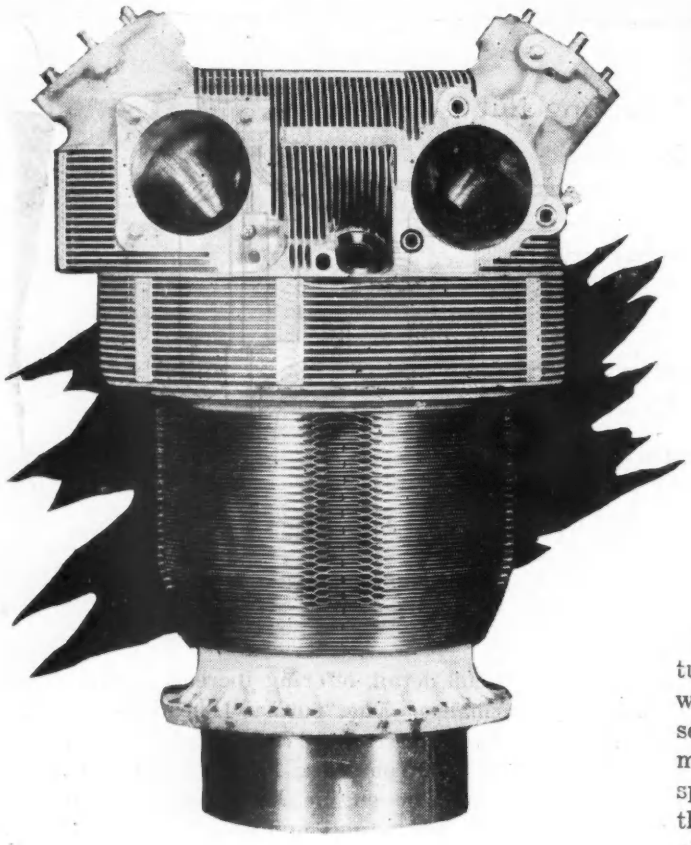


Fig. 1—Views of new front suspension unit and steering linkage on Nash "600" model.

(Above) Section through body still showing attachment to front suspension mounting bracket.

(Left bottom of facing page) Section of center arm self-adjusting ball joint



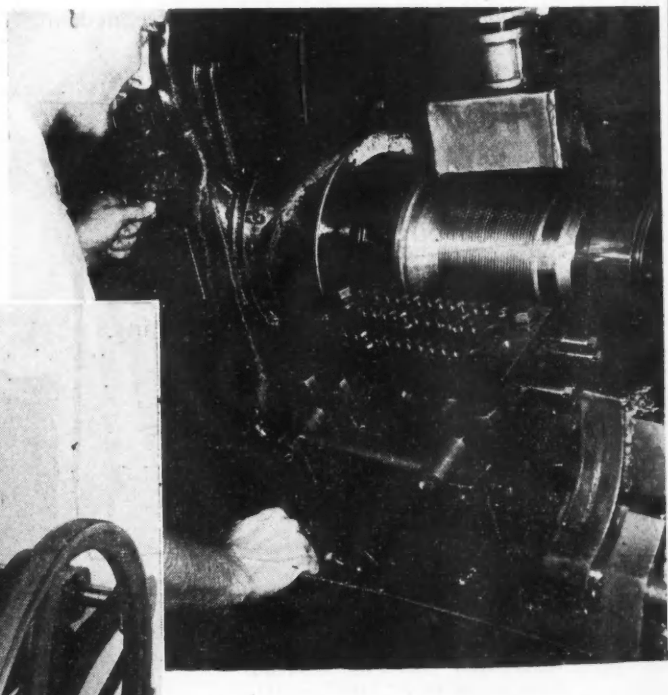
Latest type of Wright cylinder featuring a forged aluminum head and "W" finned barrel.

Fin

By J. W. Cunningham and H. L. Linsley

THE steady increase in the power output of Wright Cyclone engines during the past 20 years has necessitated a continued program of research in order that the increased heat generated might be properly dissipated. Of the total heat produced in the cylinder, the percentage rejected to the cooling fins tends to remain constant, and in order to permit engine operation within safe temperature limits the need for greater cooling fin area is apparent.

The first air-cooled engines produced by Wright featured a steel liner enveloped by a cast aluminum cylinder with integrally cast fins. Later, this design was superseded by a single-piece steel barrel in which the fins were machined from the solid forging, and by 1935 these were spaced 6.67 per inch with a depth of 0.437 in., and with a thickness of 0.030 in. Notable power increases were made about this time which made it necessary to develop new



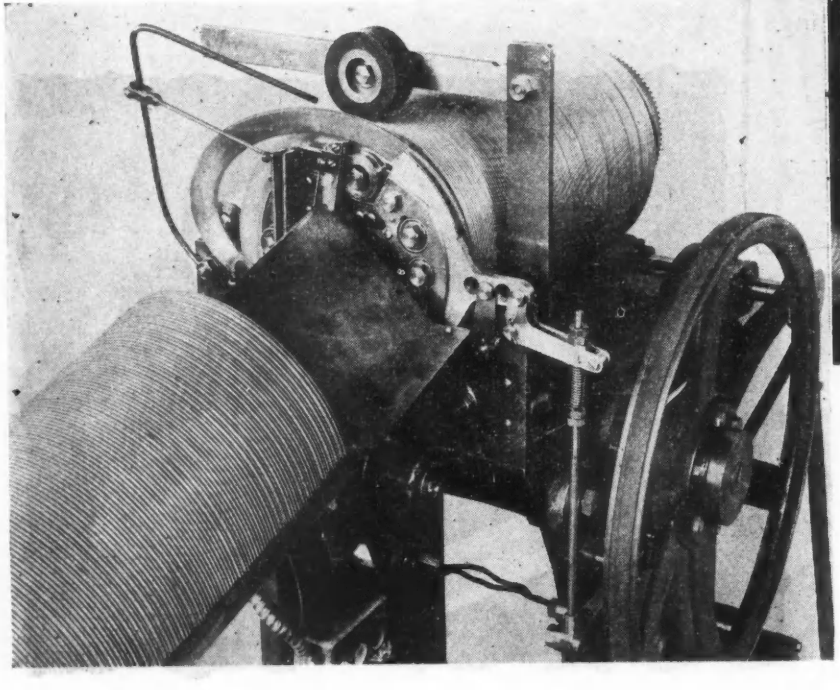


Fig. 2—Cutting the concentric grooves in the wall of the cylinder barrel on a Fay automatic lathe.

Fig. 1—Cut-off machine for making individual half sections of "W" fin from a coil of formed aluminum.

Development

to improve performance of Wright Air-Cooled Engines

manufacturing techniques so as to produce fins 0.625 in. deep, 0.025 in. thick, and spaced 8.50 per inch, a pattern for integral fin barrels which has remained in use until the present time. About 1939, however, engines in the 2000 hp range began to be built, and it became apparent taht a further advance in fin design must be made. Improving the conductivity of the fine offered a possible solution, and several methods of attaching high-conductivity fins to steel barrels were proposed. The advantages of applying copper or aluminum fins to a steel barrel would be that engine horsepower output could be increased, and the weight of each cylinder reduced. Piston and piston ring life could be increased, manufacturing costs possibly reduced, and substantial savings effected in the critical alloy steel used for the barrels. Furthermore, by reducing the cooling air flow requirements, the speed of the aircraft could be increased.

Because of the extremely high heat conductivity of copper, the first experiments were made with this material, and a satisfactory brazing technique was developed. Rings of sheet copper were stamped out and brazed to the barrel one at a time, but it was found almost impossible to maintain uniform spacing, and the method was altogether too slow for quantity production use. Moreover, considerable warpage of the steel barrel was encountered. This design was not

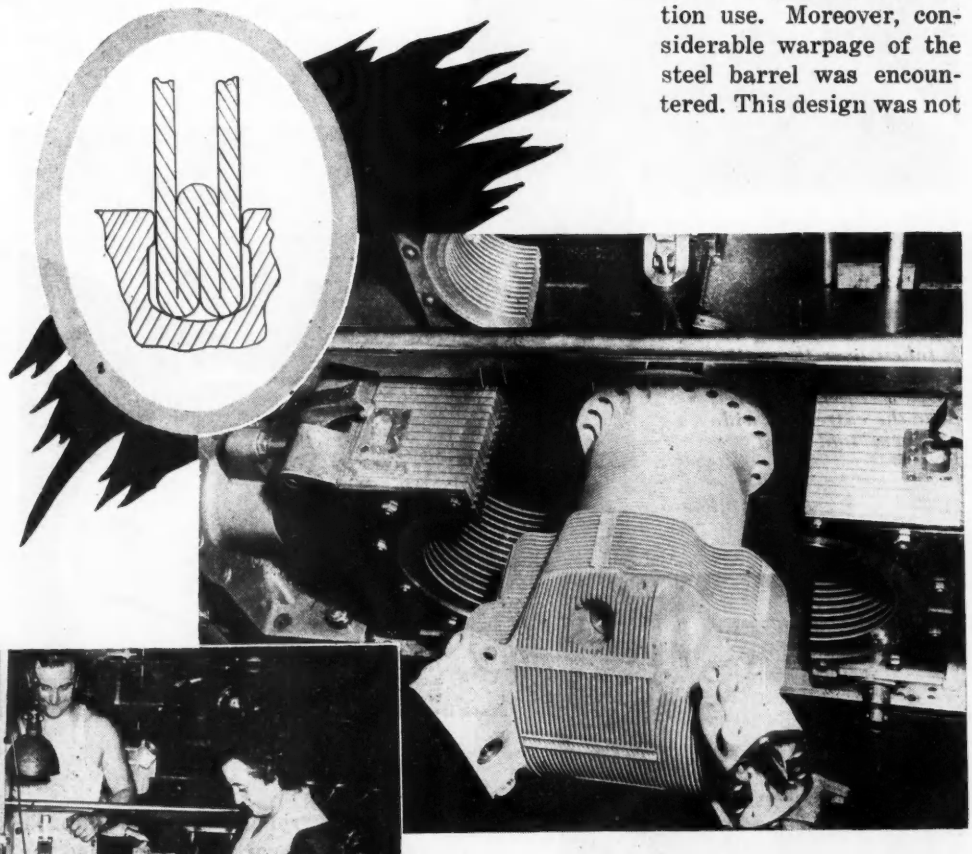


Fig. 4—Close-up of the special hydraulic machine for attaching and staking the fins to the barrel.

Fig. 3—"W" fin segments are loaded into magazine blocks prior to assembly on the barrel.

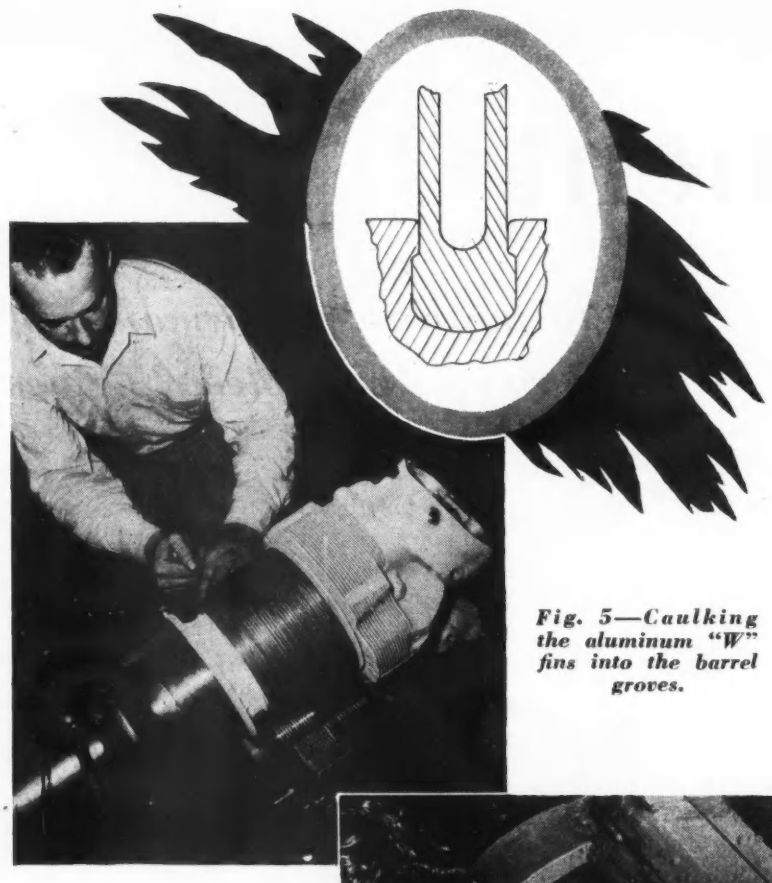


Fig. 5—Caulking the aluminum "W" fins into the barrel groves.

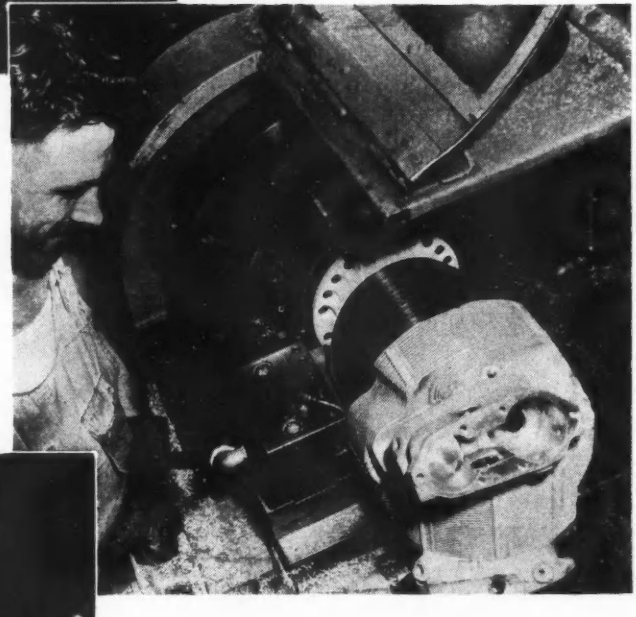


Fig. 6 — A shaving cut is taken over the entire length of the finned portion of the barrel. Note the extremely wide form tool used.

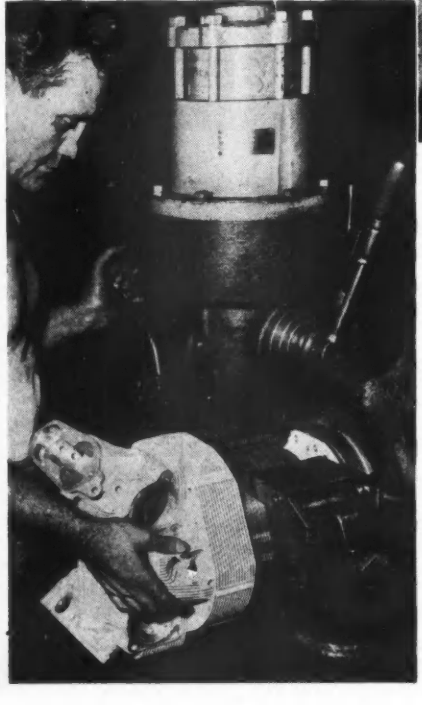


Fig. 7 — Special press for crimping the "W" fins to maintain spacing and rigidity.

accepted for production, since there was an increase in weight of four pounds per cylinder over the integral steel fin barrel, and furthermore, tests indicated that copper finning did not cool materially better at the hottest part of the cylinder than aluminum finning. To reduce the weight of the copper fin to the equivalent of aluminum for comparable heat flow, would require that the copper be so thin and fragile as to be impractical. Some method would also be required for protecting the brazed joint between fin and barrel from corrosion, but this was not worked out since the design was abandoned.

Concurrently with the brazed copper fin experiments, brazed aluminum fins were tried. Several months of laboratory work were required before a method was discovered for brazing the aluminum to the steel, but none of the results obtained were entirely satisfactory, and the project was abandoned.

An effort was then made to attach sheet metal fins in a cast - on aluminum muff, as this seemed to offer a relatively easy manufacturing process. Stamped aluminum fins, 0.025 in. thick, were stacked in a special fixture which held them spaced 9.0 per in. This was then centered about the smoothly finished barrel in such a way that the inner diameter of the fins protruded approximately 0.062 in. from the fixture and distant about 0.125 in. from the outer wall of the barrel. The base of the fixture was closed, and molten aluminum poured in from the top so as to produce a cast-on muff aproximately 0.250 in. thick, presumably bonded to the steel of the barrel and the aluminum fins. Several barrels were made by this method, and carefully examined. It was found that the muff was not bonded to the fins, and only between 25 per cent and 50 per cent to the barrel, but nevertheless one cylinder was tested for a short time on the single-cylinder test stand. Following this run, it was found that the bond between the muff and the barrel was destroyed completely, and the muff was cracked completely around the middle. Several other attempts were made to obtain a good bond between the parts, but all results indicated that such a process was not adaptable to the specific application.

The failure of the cast-on muff led to experiments with a forged aluminum muff shrunk on to the barrels and having the fins machined from the forging. This system would allow considerable

(*Turn to page* 120, *please*)

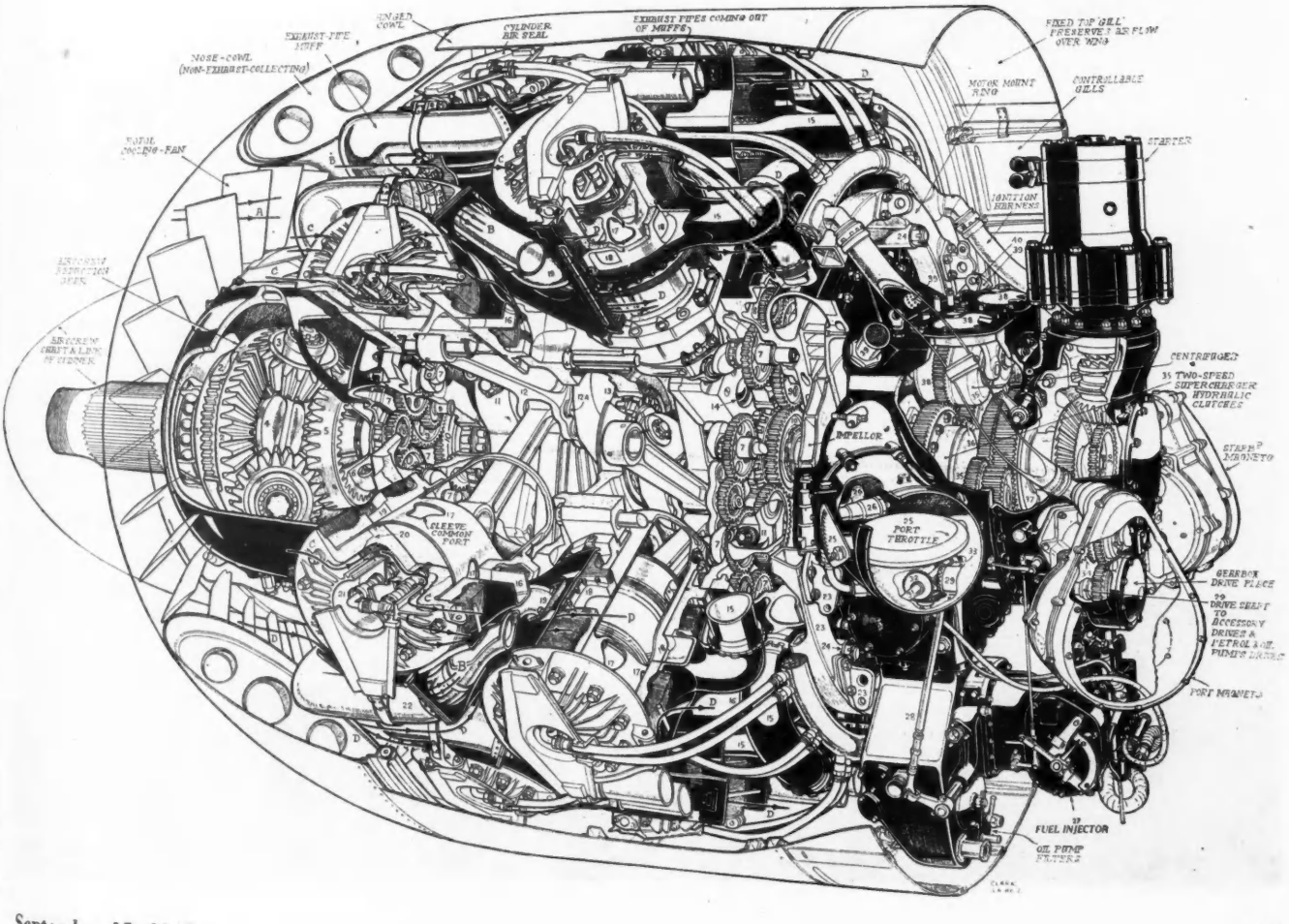
Centaurus Aircraft Engine

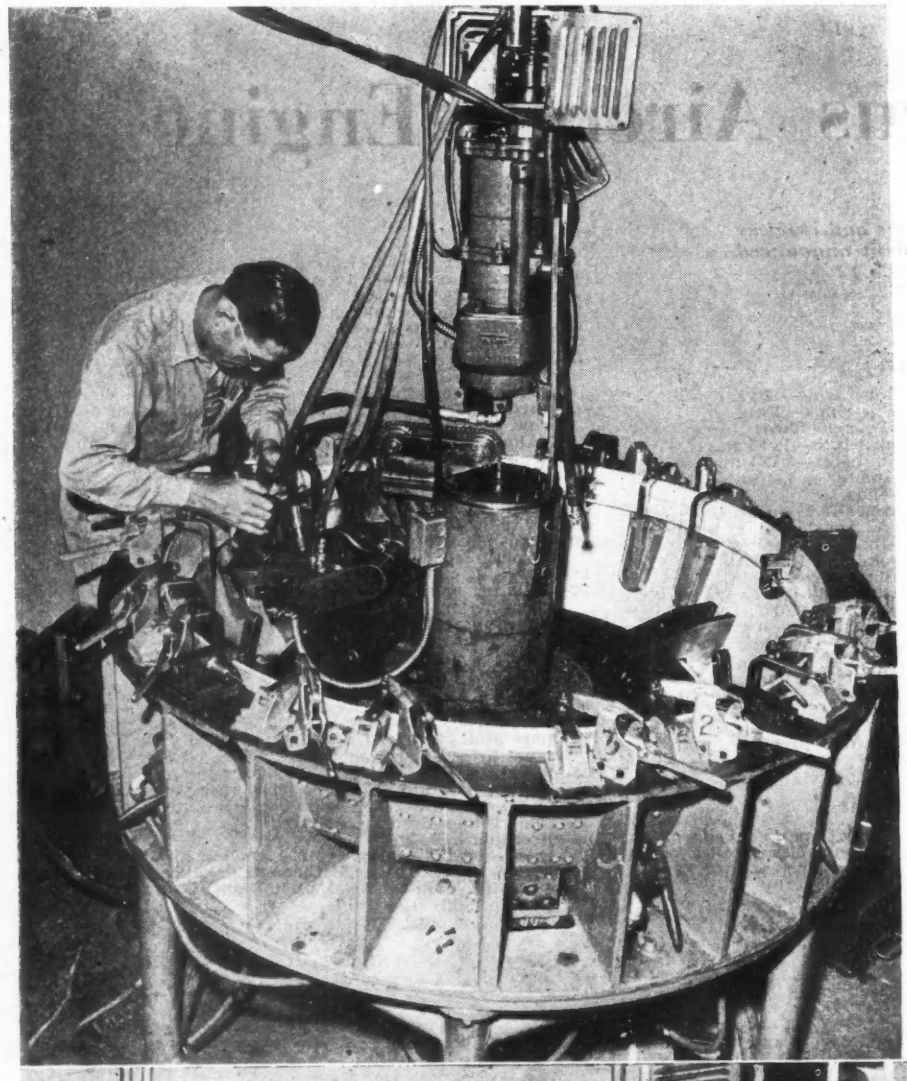
(Presented here are specifications and cutaway drawing of new British powerplant announced by Bristol Aeroplane Co.)

Centaurus Data

Number of cylinders—18, double banks of nine.
Valve type — Single sleeve-valve drive by symmetrical gear trains to radially disposed sleeve-actuating shafts.
Type of supercharger — Single-stage.
Type of carburetor—Hobson R. A. E. injector with nozzle in each air entry.
Cylinder bore—5.75 in.
Stroke—7 in.
Capacity—181.7 cu in.
Engine capacity—3,270 cu in.
Diameter—55.3 in.
Frontal area—16.65 sq ft.
Length to rear cover—66.15 in.
Weight—2,780 lb.
Fin area per cylinder—4,677 sq in.
Piston area per cylinder—25.97 sq in.
Inlet port area—6.65 sq in.
Exhaust port area—4 sq in.
Length of piston—3.52 in.
Compression ratio—7.2 : 1.
Compression rings—Two.
Oil control rings—Two.
Master rod length—14.85 in.
Big-end diameter—3.783 in.
Crank diameter — 4.4 in. center; 3.95 in. ends.
Big-end area—12.05 sq in.
Articulated rod-bearing area — 1.583 sq in.
Sleeve stroke—2.8 in.
Impeller diameter—14.5 in.
Impeller ratio, M—6.757 : 1.
Impeller ratio, S—9.014 : 1.
Propeller shaft ratio—0.44 : 1.
Maximum bhp—2,500 plus at about 2,700 rpm.
Maximum bmep—224 psi plus.
Maximum mean piston speed — 3,150 fpm (abs).
Power per cu in.—0.77 hp
1 ata manifold pressure maintained to 28,000 ft.
Weight per hp—1.11 lb.

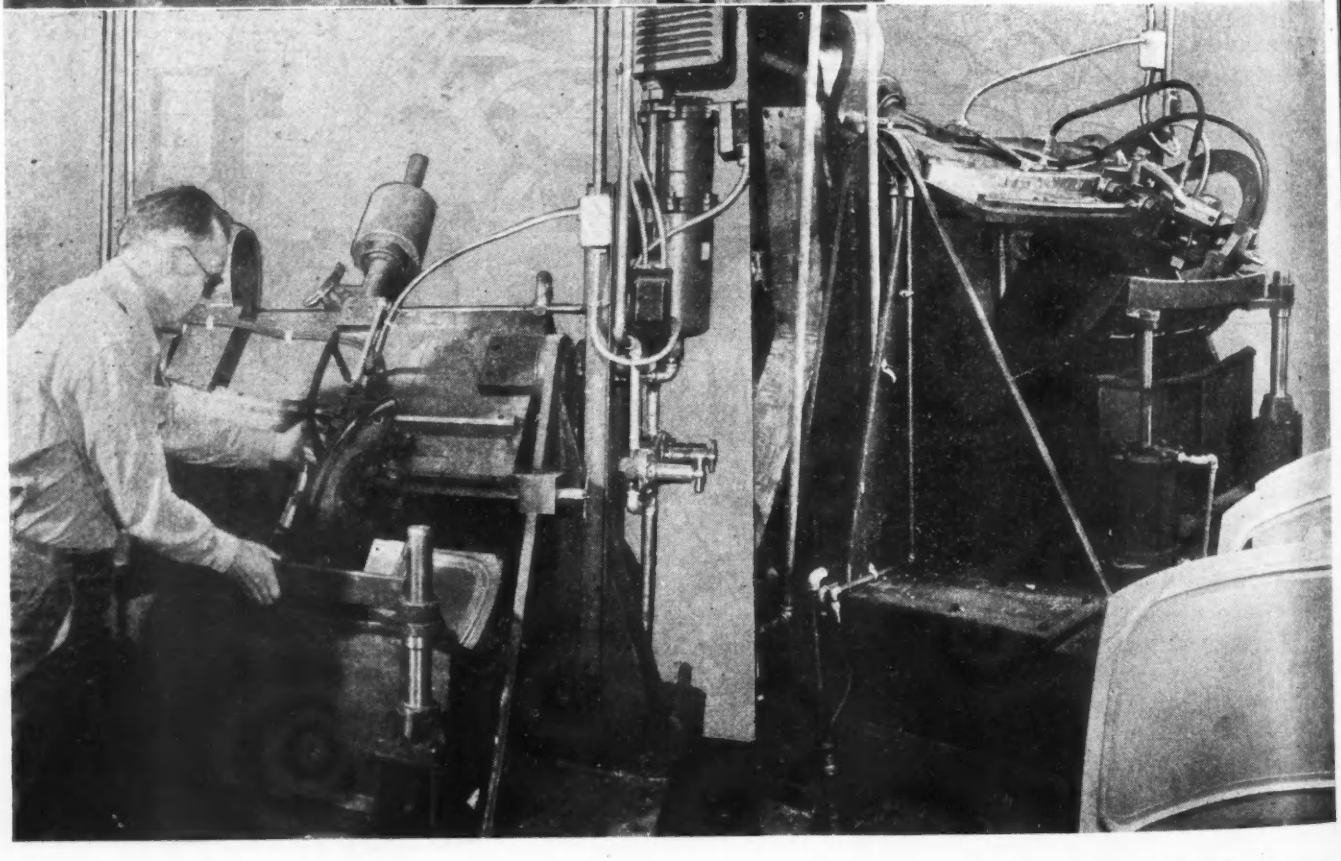
1—Spline fixed to front cover holds stationary bevel gear 2,
3—Three bevel pinions (on spider 4) roll around 2 and rotate spider 4 which is solid with airscrew shaft.
5—Bevel gear (drives 3) and is driven by crankshaft through spline-plate 6.
7—Nine front sleeve cranks and gears, grouped in triple three. Each three in a group is intergeared by idlers 8, the middle number 7 being driven through compound train 9 from crankshaft wheel 10.
11—Double maneton bolt.
12—Master rod.
12A—Floating oil retainer takes oil to connecting rod wrist pins from big end bearing.
13—Center self-aligning bearing and one-piece crank-throws. 7, 8, 9, 10, back row timing gears, as for front row. Note cutaway reveals crankshaft maneton bolt 11.
14—Salomon-type ball dampers (crankshaft damping).
15—Rear bank inlet manifolds.
16—Front bank inlets.
17—Sleeve ports.
18—Cylinder inlet ports (three).
19—Cylinder exhaust ports (two).
20—Two-piece junk head-joint (cooling air deflected down into finned bottom half to cool the "cylinder head").
21—Sparking plugs.
22—Exhaust muffs isolate hot air around exhaust pipes from main cooling air washing cylinders.
23—Mounting ring and lugs, held to engine by bolts 24.
25—Port and starboard air intake throttles.
26—Fuel nozzles, discharge from fuel injector 27 into air intake.
28—Throttle control from cockpit to 25 and interconnected to 27.
29—Drive from tail shaft gear 30, drives cross shaft 31 for port and starboard auxiliaries. Also drives 32 and 33 (fuel injector and oil pump vertical drives).
34—Bevel drives on train 30, drive magnetos.
35—Two speed clutches driving impeller pinion 36.
37—Crankshaft tail shaft which drives clutches 35.
38—Centrifuges driven off clutches.
39—Breathers.
40—Back-end lifting lugs. Main cooling air "A" past fan, divides into stream: B through exhaust pipe muffs; C down into cylinder head, up and out; D around cylinders (inside baffles).





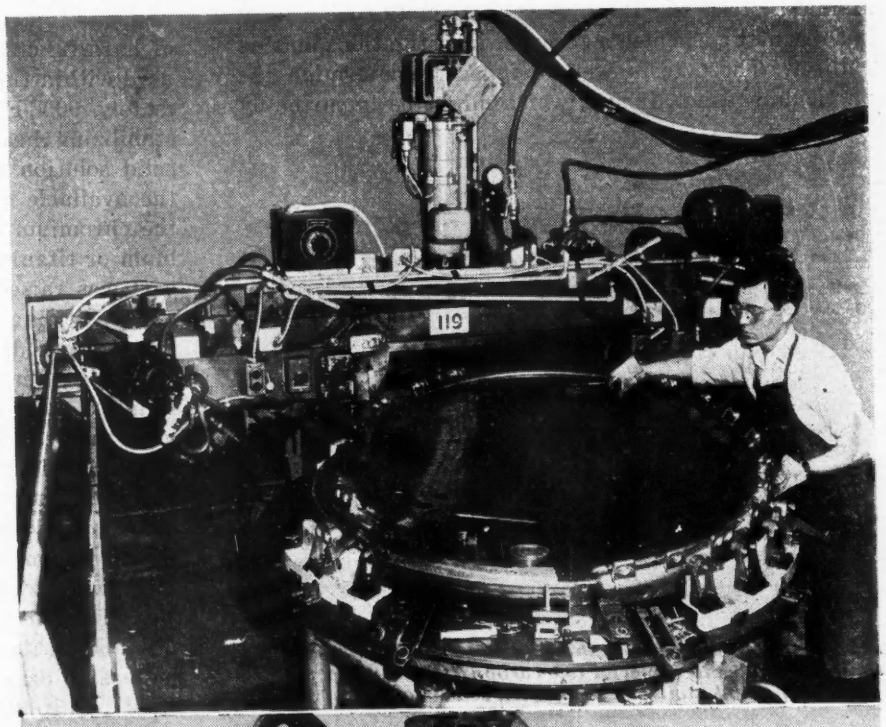
Spotweld Fi

THIS nose ring assembly and tackweld fixture is powered by a Raytheon capacitator unit and a Raytheon charging unit, capacity 4200 microfarads, with a maximum load of 3000 v and a sustained speed of 13 spots per in. This fixture uses 2400 microfarads. The transformer is the same type as used with the above mentioned firewall fixture and is built on a roller-equipped table so that it can be swung around and attached to the engine panel spotweld fixture. The fixture proper is a solid cast steel bowl with laminated Mallory copper lining. The secondary circuit is tied into the copper lining at one end and onto a rotary center post at the other. The hydraulically actuated expansion type gun closes the circuit. The gun may be spun around on a horizontal plane to any point on the inside of the nose ring. In addition, the gun is attached to a counter-balance, set inside the rotary center post, which allows the spotweld tip to travel in an arc from the middle to the aft edge of the nose ring. Three

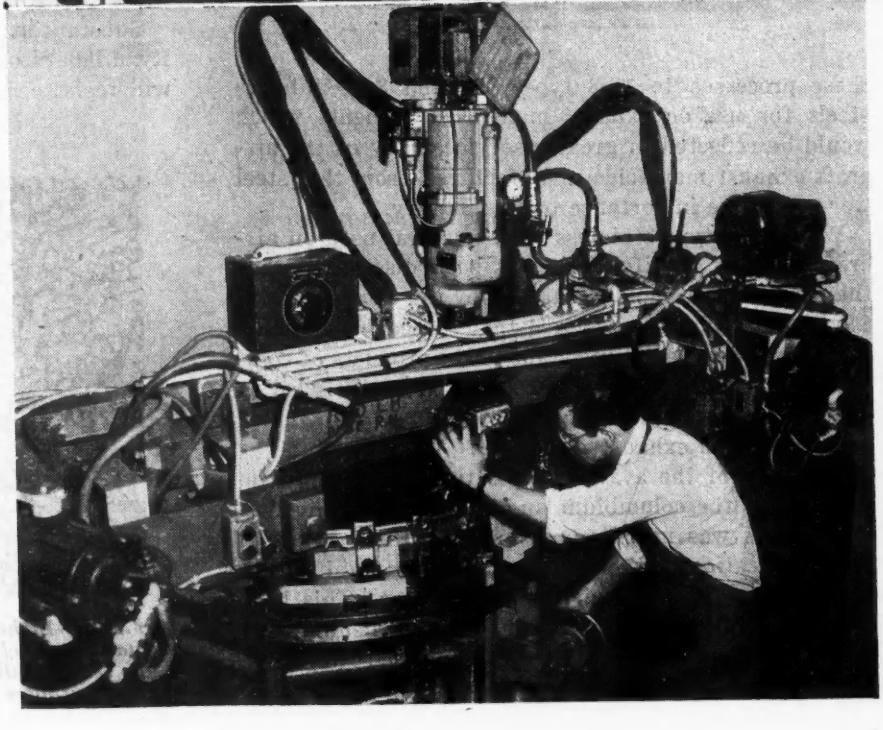


Fixtures at Lockheed

FIREWALLS for several different models of aircraft may be spotwelded on the firewall spotweld fixture by removing or inserting different Mallory copper blocks which locate the various parts to be spotwelded to the firewall sheet itself. This fixture is powered by a General Electric condenser discharge unit, capacity 2400 microfarads and a sustained speed of 25 spots per min. The transformer is a Federal with the secondary attached to the moveable table by two heavy buss bars. One of these attaches to the table which rotates; the other attaches to the bridge beam, which moves back and forth over the table as shown in the photos. The circuit is closed by an expansion type gun attached to the bridge. Two hydraulically operated shoes insure perfect contact between the buss bars, table and bridge. This fixture uses a charging voltage of 1900 KV and a condenser capacity of 720 microfarads. The transformer turn ratio is set at P-1. This will weld 0.020 in. and 0.037 in. SAE 1010 carbon steel. Production is one firewall per hr.



large segments and six thrust ring segments are held in the fixture by six hydraulically operated clamps. Each clamp is actuated by its own cylinder and can be set or released independently of the other five. The other details are held by quick action clamps. Two men can produce one nose ring per hr. This fixture uses a charging voltage of 2200 kv and a condenser capacity of 2400 microfarads. The transformer turn ratio is set at P-2; these values will tack weld 0.021 in. 24ST Alclad.



THE engine panel spotweld fixture, two views of which are shown here, uses the same power unit as the nose ring fixture. This fixture is built so that the clamping frame may be raised by means of hydraulic jacks, located on opposite corners, and the panel slid in between the frame and the fixture bed. The frame is then hydraulically lowered and locked into place. The frame is slotted so as to admit the spotweld tip for tacking purposes. The gun is swung on a counter-balanced arm and may be moved by hand from side to side by rolling on roller bearings set against the track. The circuit is completed by bringing the expansion-type gun in contact with a buss bar attached to the counter-balanced arm and parallel to the rail on which the gun rolls while in operation. The current volume and voltage used on this fixture are the same as the nose ring fixture. The electric power which operates both the engine panel fixture and the nose ring fixture is equipped with automatic cutoffs which preclude possibility of shock, thus making the machines absolutely safe to operate.

Effect of Exhaust Gases on

Stainless Steel

AS A RESULT of the rather conflicting information available concerning the effect of stabilizing and stress relief heat treatment upon welded 18-8 stainless steel, the Ryan Aeronautical Co. laboratory has recently concluded a series of investigations on this subject. These tests were deigned to determine the particular benefit, if any, which might be imparted by these processes to 18-8 types 321 and 347 stainless steels for use on exhaust manifolds. Benefits which would be reflected in greater serviceability of the aircraft exhaust manifolds manufactured from this steel were of prime importance to this inquiry.

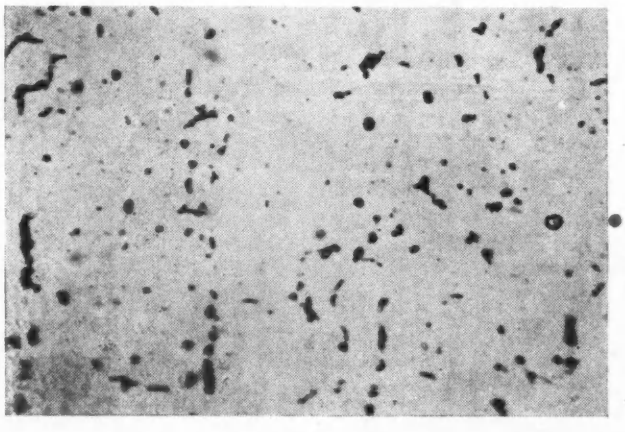


Fig. 1—Photomicrograph showing the random distribution of carbides in a special low carbon (0.025 per cent) type 304 stainless steel after sensitization.

When 18-8 type stainless steel was first used on aircraft exhaust manifolds, it was soon discovered that the material was rapidly attacked by the exhaust gases. Closer investigation disclosed that the carbides which were formed were not resistant to the products of combustion encountered in the exhaust gases. This led to the use of the stabilized grades types 347 and 321 of 18-8 for use on exhaust manifolds.

A review of the available literature shows that the addition of the columbium and titanium contained in these types was not the only means utilized to affect the stabilization of the material, but that stabilization was enhanced by a special heat treatment. This heat treatment for stabilization consisted of holding the fabricated part within a narrow temperature range of about 1575 F to 1625 F for periods of time exceeding half an hour. This serves to stabilize the carbon by precipitating it as titanium or columbium carbides in random dispersion within the austenite grains. The result is that no carbon is available for the formation of harmful chromium carbides if the material is to be used within the so-called sensitizing range of approximately 900 F to 1500 F. In theory, without this stabilizing heat treatment and with the carbides in solid solution in a properly annealed austenitic steel, the available carbon might conceivably combine with the chromium carbides, and not with those of columbium or titanium. This could occur when the finished part was raised to the operating temperatures within the sensitizing range.

It is agreed, therefore, that the theory behind the stabilizing heat treatment on the stabilized grades of stainless steel is correct, and from the standpoint of resistance to corrosion in electrolytes and highly corrosive solutions, the stabilizing heat treatment may be required. However, correlation between corrosion under these conditions and resistance to the type of corrosion obtained from exhaust gases in exhaust manifolds is not satisfactory. The specification analyses covering the minimum amounts of columbium and titanium allowable in the 18-8 stainless steels are such that adequate stabilization of the carbides is present for exhaust manifold use without special heat treatments.

Substantiating facts have been accumulated by the Ryan laboratories which show that exhaust manifolds will resist corrosion where a combined precipitate of

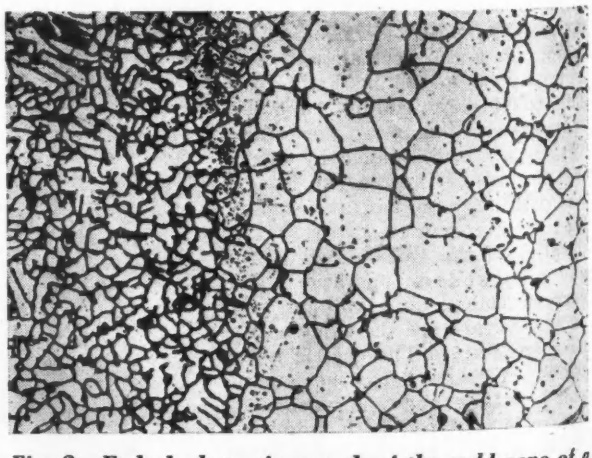


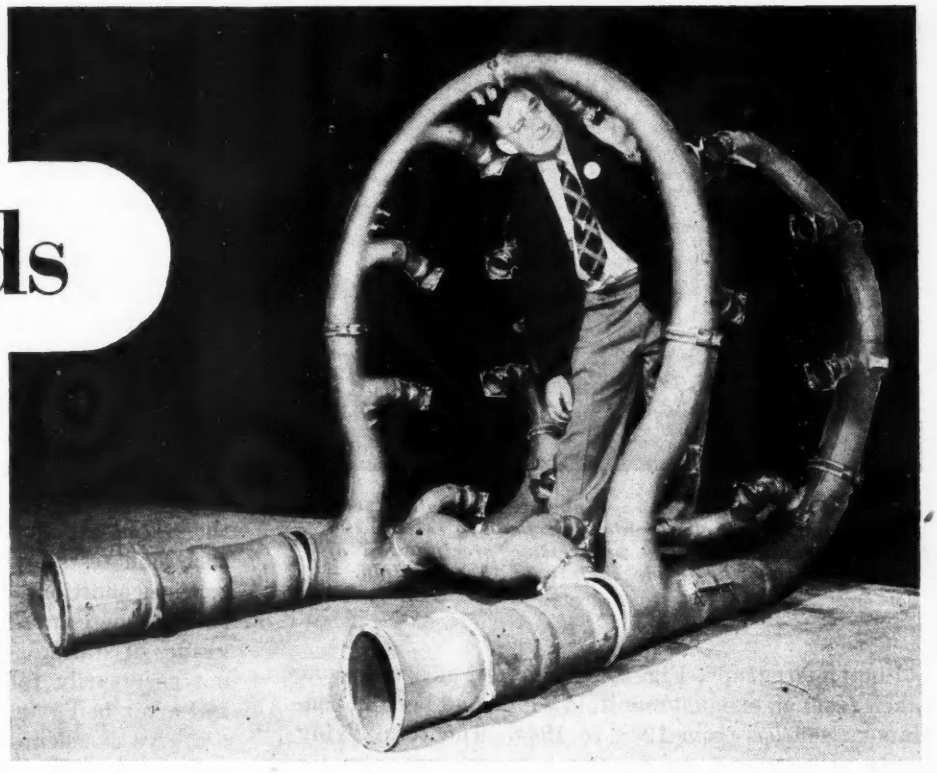
Fig. 2—Etched photomicrograph of the weld zone of a stainless steel exhaust manifold section which had been in service 4000 hr. Note the well-defined networks of carbides which did not affect its service life.

Manifolds

By Wilson G. Hubbell,

Chief,

Metallurgical Laboratory,
Ryan Aeronautical Co.



Exhaust collector for 18-cylinder Wright twin-row engine with front and rear exhaust outlets for the B-29 bomber.

columbium or titanium carbides and chromium carbides exists after sensitizing the annealed material. To account for this, photomicrographs were taken which show that even throughout the annealing heat treatment accomplished by cooling in air from 1950 F to 2000 F, a percentage of the carbon will remain with columbium or titanium. This leaves a small amount of uncombined carbon which in theory should combine with the chromium if held within the sensitizing range for a sufficient period of time. The amount of available carbon left for the formation of chromium carbides is very small. Photomicrograph, Fig. 1, shows how the carbides after sensitization are distributed in an 18-8 type unstabilized stainless steel having 0.025 per cent carbon. From this, it is safe to assume that uncombined carbon of 0.025 per cent, and possibly up to as high as 0.04 per cent, can be tolerated without fear of inter-granular attack by exhaust gases. The reason for this is that the available carbon is so rapidly depleted in combining with the chromium that it remains in broken particles dispersed irregularly along grain boundaries. This condition leaves no continuous path for corrosion to take as in the case of a relatively high carbon, unstabilized 18-8 stainless steel. The micro-structure of a completed exhaust manifold fabricated from type 347 or type 321 stainless steel shows columbium or titanium carbides at random dispersion within the austenite grain and a dispersion of chromium carbides along grain boundaries spaced at such distances apart as to be no cause for concern over the ultimate serviceability of the exhaust manifold.

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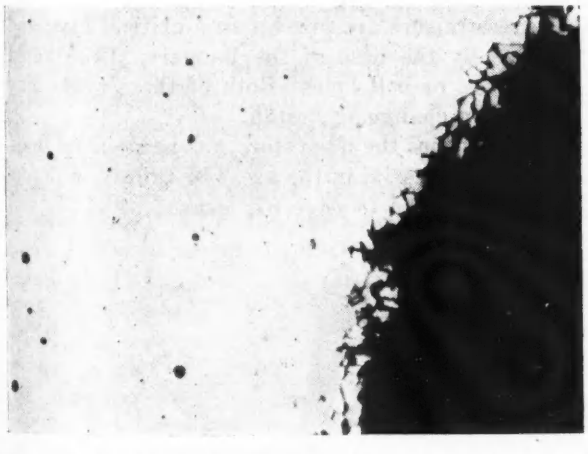

Fig. 3—Unetched photomicrograph of the weld zone of the exhaust manifold which had been in service 4000 hr. This picture indicates the depth of corrosion which occurred during the life of the manifold—only 0.005 in.

Ryan formula for 18-8 stainless steel, columbium type 347.

	Per cent
Carbon	Less than 0.06, preferably less than 0.05
Manganese	1.30 to 1.50
Phosphorus	Less than 0.02
Sulphur	Less than 0.015
Chromium	More than 17.0
Nickel	More than 10.5
Columbium	More than eight times the carbon content

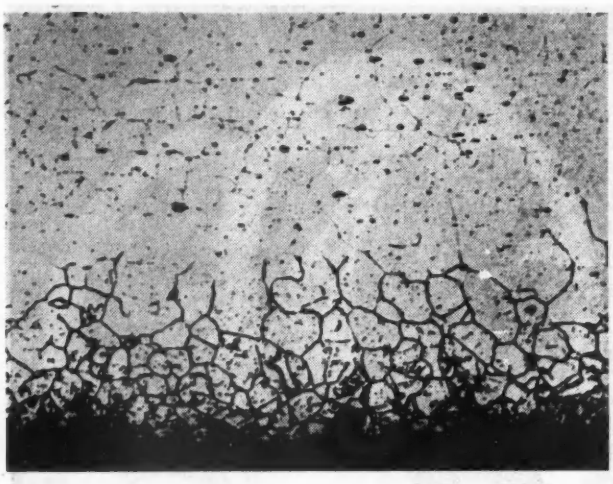

Fig. 4—Etched photomicrograph of a stainless steel exhaust manifold section which had been in service 100 hr. This picture shows a progressive precipitation of carbides from the inside surface of the manifold.

Photomicrograph, Fig. 2, is a picture of a weld zone taken from an exhaust manifold which had been in continuous service from 1938 to 1944. The total flying hours accumulated during these years approximates 4000 which is in excess of the normal life of an exhaust manifold. This manifold was returned for the replacement of an exhaust port which had become worn by mechanical means during use. No breakdown of the metal in the form of cracking or corrosion was noted with the exception of an attack which had progressed to not over 0.005 in. on the inside surface of the body of the manifold. According to the criteria by which stainless steels and stainless steel welds are judged in many specifications, the photomicrograph of this manifold would be cause for great concern. This is due to the heavy network of carbides progressing throughout the original sheet, and an even heavier network in the region of the weld zone. Yet, the photomicrograph (unetched) in Fig. 3 showing the depth of corrosive attack by exhaust gases quite conclusively indicates that the presence of the carbides, even with their continuity becoming more definite, does not contribute to an excessive cause for corrosive attack by the exhaust gases. This bulwarks the contention that there is little or no relationship between the life of an exhaust manifold and the strict condition that all carbides must be combined with the columbium or titanium and dispersed within the austenite grain.

Further considerations are being given to the possibility of carbon absorption during the service life of exhaust manifolds. Photomicrograph, Fig. 4, shows the cross section of the body on a manifold which had been in service for 100 hr. It is quite apparent that there is a relationship between the time in service and the type and distribution of carbides, dependent upon the service conditions. In connection with this, we have found that sections taken from the manifolds which have been in service and subjected to the copper-sulfate-sulfuric acid solution show up to a 20 per cent greater loss in thickness due to corrosion by the electrolytes after 48 hr than will be obtained under service conditions up to 4000 hr. It is from these tests that we conclude that there is no correlation between the required accelerated corrosion tests as outlined by specification and actual service conditions. Some type of corrosive test is necessary to determine the susceptibility of the various grades of stainless steel to carbon precipitation, but it not necessarily follow that if these materials should fail after being tested in strong electrolytes they will not give excellent service under operating conditions. Such tests are of little value if they cannot be correlated with conditions of service.

It is interesting to note that the wealth of material gleaned from service reports over a period of years at the Ryan plant shows conclusively that there are two major types of manifold failures: One is due to fatigue failure which occurs in an open area subjected to strong pulsating forces—particularly in relatively flat areas. The other type of failure is encountered when severe stress raisers are present in a critical area and are typified by the base of the hangers, the edge of doubler plates, or bolt holes. Both of these types may be rectified by change in design.

At various times the laboratory has been called upon to analyze the material in the areas of failure to deter-

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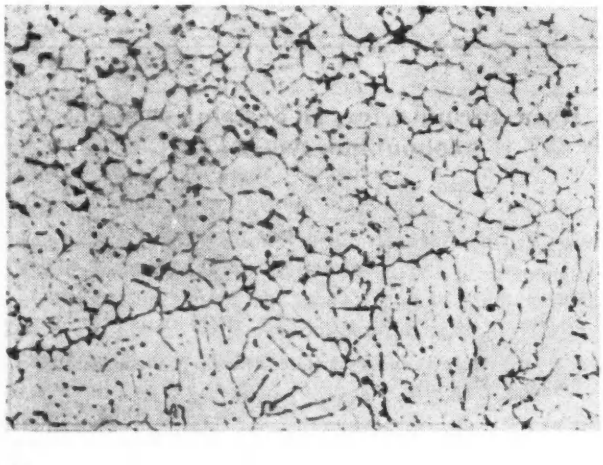

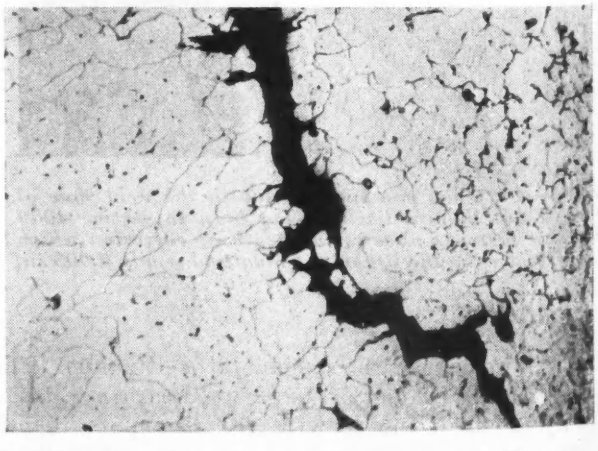

Fig. 5—These two photomicrographs are of gas-welded zones of columbium and titanium-stabilized stainless steels in the sensitized condition and after the Strauss test. The columbium-stabilized sample A (at left) shows good corrosion resistance. The titanium-stabilized sample B (above) does not have as good corrosion resistance but in view of the severity of the Strauss test with respect to actual service conditions this is no cause for alarm.

Basic Factors of Helicopter Design

in Simplified Form

By R. H. Prewitt
Chief Engineer,
Kellett Aircraft Corp.

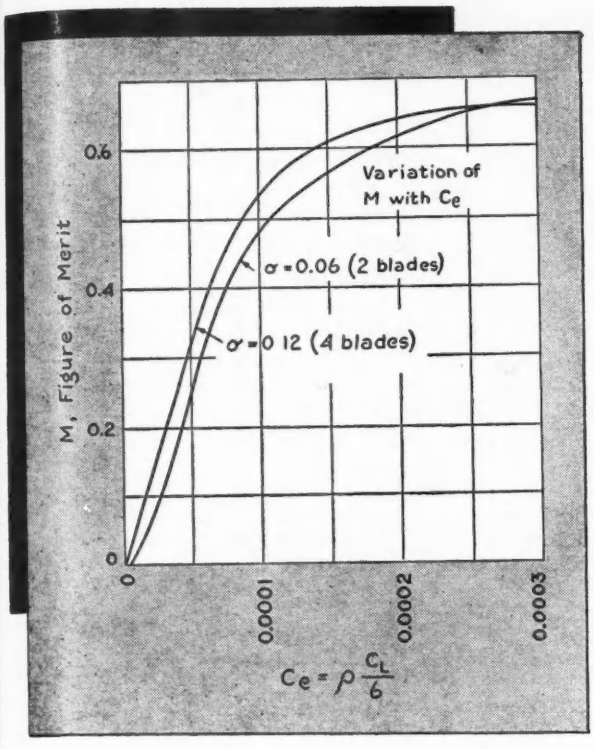

Fig. 1—Variation of Figure of Merit, M, with Coefficient of Lift, C_e.

THE lifting capacity of a helicopter in fixed sustentation depends upon: (a) The power supplied to the rotor, (b) The swept area of the rotor, (c) The operating angles of attack of the blade elements, (d) Operating altitude, and (e) The blade form. This article is concerned primarily with the first four factors.

The thrust of a rotor in fixed sustentation is the product of the mass of air passing through the rotor per second and the acceleration of that mass of air. The mass of air is AV_1d where "A" is the disk area in sq ft, "V_1" is the velocity through the rotor disk in ft per sec and "d" is the mass density of the air per cu ft. (The acceleration of the air is the change in velocity.) In the case of a helicopter in fixed sustentation, the velocity is zero at a great distance above the rotor, and maximum just below the rotor. The acceleration is from zero velocity to the down-flow velocity (V_2), just under the rotor. The expression of rotor thrust (T) becomes:

$$T = AV_1\,dV_2$$

It can be shown that the velocity of down flow (V_2) just after passing through the rotor is twice the velocity of flow V_1 at the time the blades strike the air or $V_2 = 2V_1$.

The theoretical power required for sustentation is the product of the thrust (T) of the rotor and of the velocity of flow (V_1) through the rotor disk. This relationship may be written in terms of horsepower (Hp) as follows:

$$Hp = \frac{TV_1}{550} \text{ or } V_1 = \frac{550\,Hp}{T}$$

By equating the values obtained for the flow through the rotor (V_1), as shown in the above equations, a simplified expression of the fundamental relationship of thrust, power, disk area and air density (altitude) can be obtained:

$$\frac{T}{Hp}\sqrt{\frac{T}{A}} = 38, \text{ at sea level where d} = 0.002375$$

Since T/Hp is the power loading (PL) and T/A is the disk loading (DL) (both frequently-used terms in helicopter design), the previous equation provides a convenient means of comparing helicopter rotor efficiencies.

A figure of merit (M) is employed as a multiplier of the right-hand side of the equation to meet practical needs. The quantity (M) is the ratio of theoretical power requirements divided by the actual power requirements of a given helicopter in fixed sustentation. The actual power requirement will be greater than the theoretical power requirements by power losses from the following sources: Power is consumed in turning the blades even though no lift is being produced (this is commonly called "profile loss"); and to produce optimum distribution of lift over the rotor disk, the blades should be tapered in plan form toward their tips and should be twisted so that each of the elements along the blade span operate at an efficient angle of attack. (Seldom, if ever, are optimum plan form and twist obtained.)

Fig. 1 shows a plot of the figure of merit (M) vs. coefficient of lift for two helicopter rotors in fixed sustentation. When sufficient data are available from model and full-scale flight tests, in the form shown on Fig. 1, the static lift of helicopters may be accurately determined. Likewise, the effects of blade twist, plan form, chordwise center of gravity and airfoil characteristics can be accurately compared provided tests are conducted at, or corrected to, the same Reynolds number.

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This paper was prepared from the paper of the same title presented at the War Engineering-Annual Meeting of the Society of Automotive Engineers, Jan. 8-12, 1945, at Detroit.

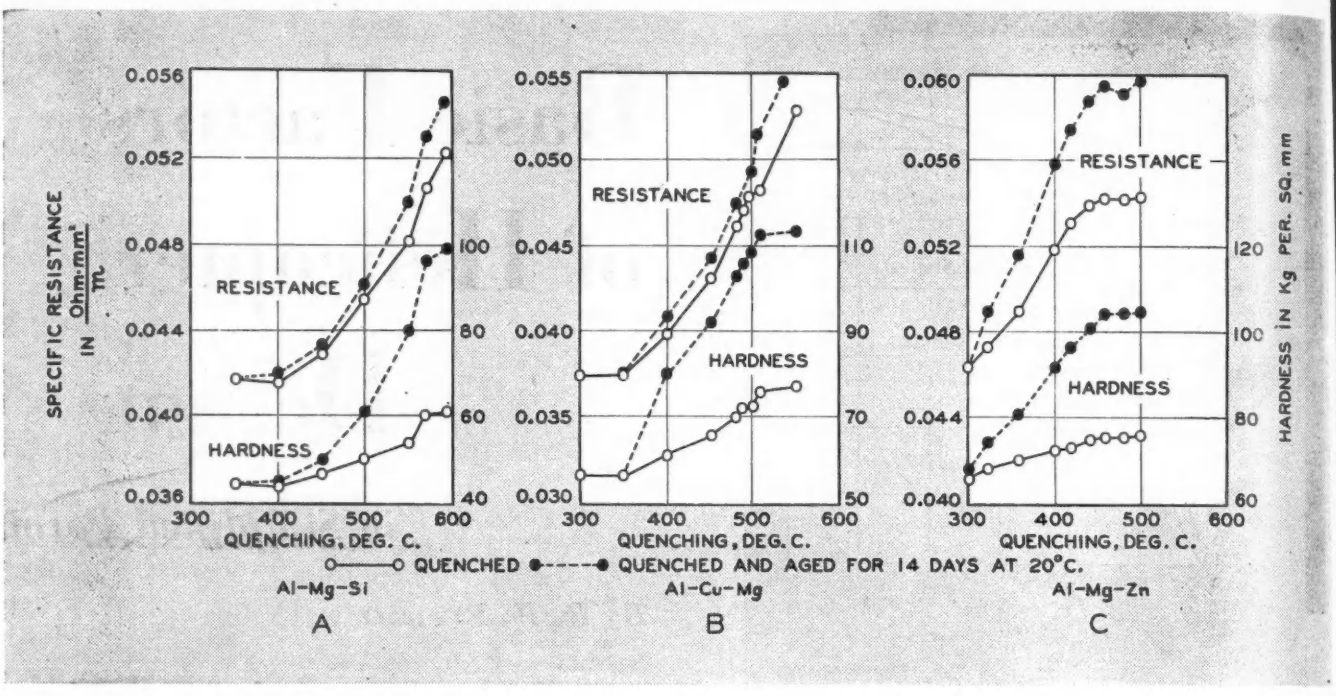

Fig. 1. Resistance and hardness of three aluminum alloys (after quenching and after aging) in dependence on the quenching temperature.

Electrical Conductivity as Measure of

IN NON-DESTRUCTIVE methods of testing materials by magnetic induction, electric conductivity is used to classify the material and its condition. Conductivity measurement shows differences between individual samples, and also differences between various alloys and between various states of a given alloy, provided the alloys or conditions compared differ in conductivity. If the change in conductivity resulting from thermal or mechanical treatment has been ascertained it can be used to identify the treatment. Further, it can be employed for the indirect determination of any other regularly related property.

An instance of the foregoing is the indirect determination of the hardness of cold-aged aluminum alloys, to which attention was first drawn at a meeting of the Kaiser Wilhelm Institute für Metallforschung in 1941. The purpose of this article is to present the results of comprehensive experiments. Three alloys were investigated, as follows:

(1) Aluminum-Magnesium-Silicon (1.0 Mg, 1.0 Si, 0.87 Mn, 0.52 Fe, 0.02 Cu, Al remainder)

(2) Aluminum-Copper-Magnesium (4.2 Cu, 0.70 Mg, 0.55 Mn, 0.30 Si, 0.45 Fe, Al remainder)

(3) Aluminum-Magnesium-Zinc (4.5 Zn, 3.5 Mg, 0.3 Mn, Al remainder)

In the measuring apparatus one ordinate on the cathode ray tube showed the change in conductivity and the other the change in hardness.

Bars, 10 mm diam and 100 mm long, were placed in a search coil. The bars were measured at a constant

This article consists of excerpts from a report by F. Forster and H. Breitfeld published in a German periodical. Translation provided by the British Ministry of Aircraft Production.

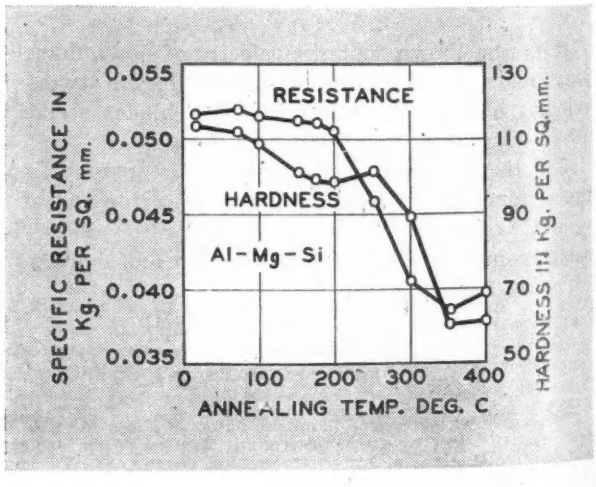

Fig. 3. Change in hardness and resistance on annealing a cold-aged alloy of Al-Mg-Si.

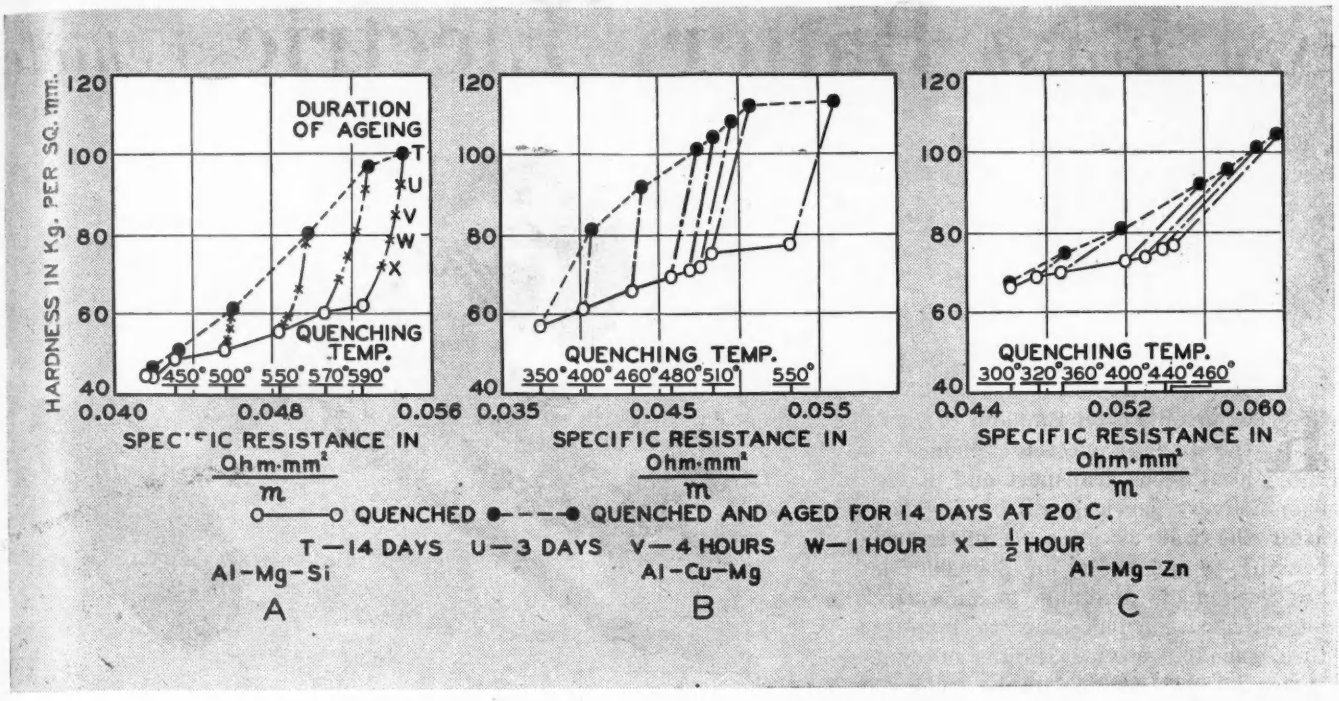

Fig. 2. Hardness of three aluminum alloys in connection with specific electric resistance.

Hardness *in Cold-Aged Aluminum Alloys*

temperature, to which they were brought in an oil bath before each measurement, as is essential for obtaining comparable values. The alloys were first annealed at 300-350 C to bring them into a condition of equilibrium, and then quenched. The change in specific resistivity and the Brinell hardness were subsequently determined during ageing at room temperature.

In Fig. 1 both properties are plotted over the quenching temperature. Resistance and hardness both increase with a rise in this temperature corresponding to the intensified formation of mixed crystal.

The extent of modification by cold-aging also increases with a rise in quenching temperature. In Fig. 2A the combined values of specific resistance and of hardness are plotted; it is clear that hardness increases approximately linearly with resistance, both immediately after quenching and after complete hardening. It is, therefore, actually possible to deduce the hardness from a measurement of conductivity, as soon as a calibration curve has been plotted for the particular alloy.

In Fig. 2A the transition from the quenched condition to the cold-aged condition is shown for various times as a parameter. During transition both qualities are not generally proportional to one another. In the final condition, however, this is the case. In practice it does not matter if the hardness throughout the whole temperature range is not proportional to the resistivity; it suffices if this obtains in the narrower range about the technically practicable quenching tem-

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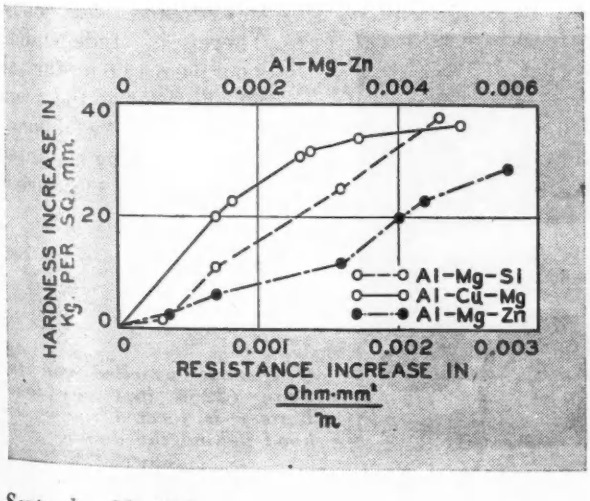
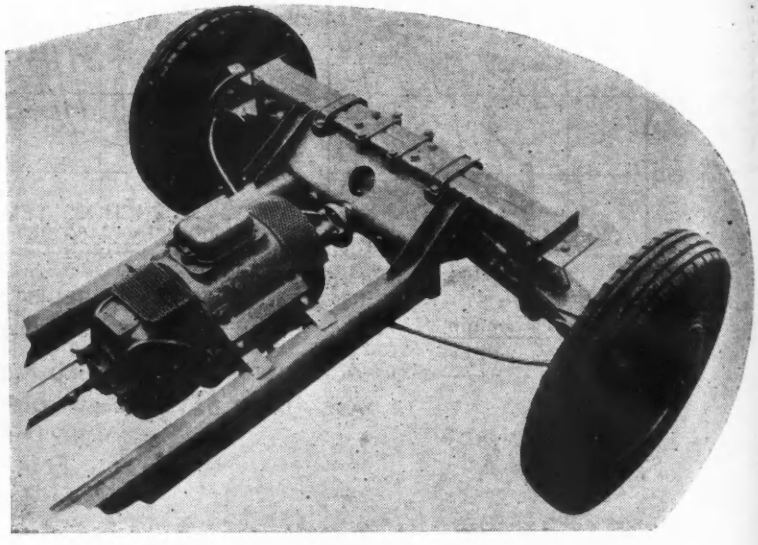


Fig. 4. Increase in hardening during aging in connection with the increase in resistance.

New British Battery Electric *Vehicle*



Rear of 1-ton (2250 lb.) load capacity Q Electric chassis, with central motor and independent suspension.

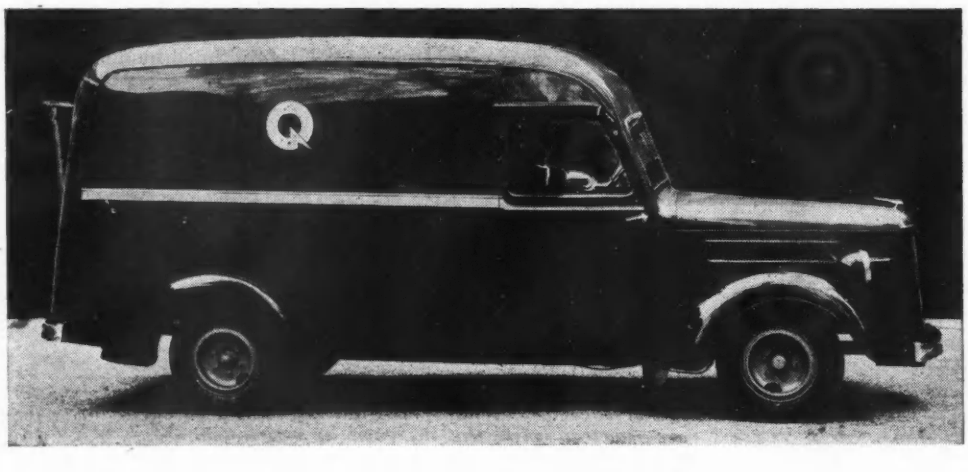
RECENT efforts in England to extend the use of electric vehicles for local goods transport and door-to-door delivery services will be intensified after the war as a result of financial backing to the extent of £500,000 that has been made available to an entirely new British undertaking to manufacture, sell and service designs of a new battery-electric vehicle to be known as the Q Electric. It is stated that the capital required by this undertaking is being provided by the United Molasses Co., though why this £13,000,000 company should interest itself in electric vehicle manufacture is not explained. It is easier to understand why, a little while ago, it made an offer for the shares of a big shipping company.

The new vehicles, prototypes of which are already being demonstrated, will be produced ("mass production" is promised) by a well-established engineering company in the north of England—Steel Engineering Products, Sunderland. Sales and service will be in the hands of the Q Electric Co. with headquarters in London and service depots established all over England in co-operation with electric supply undertakings, municipal and private.

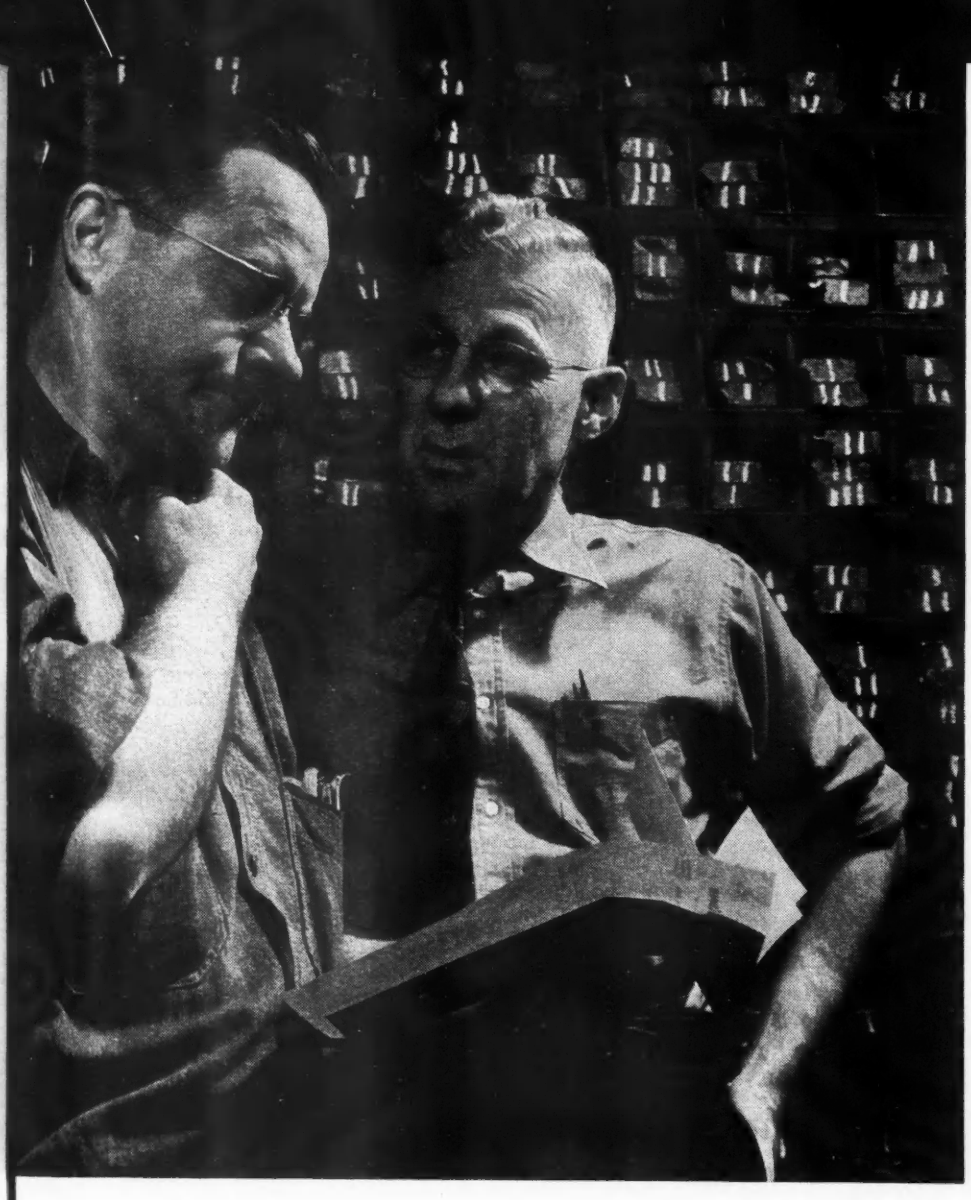
Two models are ready for production, with a useful load capacity of 1 long ton (2250 lb.) and 2½ tons (5000 lb.), respectively. The terms to be offered to prospective users are unique, so far as British products of this kind are concerned. Thus, the smaller model will be "sold" on a five-year deferred payment plan, with a weekly payment of £1 towards a total cost of £250. No charge will be made for the battery or the rectifier; these will be rented or hired to the user, also for the payment of £1 per week. Free service and routine maintenance at stated intervals will be an important feature of the marketing plans, and four times a year the battery will be overhauled (renewed if necessary) and given a free full charge. The larger model will be subject to purchase payments of £2 per week to a total of approximately £500.

As regards constructional features, the smaller model has a "twin backbone" frame consisting of two longitudinal and parallel tubular members, with outrigger cross members welded to the tubes to support the body. There is independent suspension for all wheels, that at the front being of the "wishbone" type employing a jointed

Turn to page 118, *please*



Q Electric panelled van for 1-ton (2250 lb.) pay load. Battery is located under the hood behind the dummy radiator.



Metallurgists and steelmakers review all orders that enter the Inland mill.

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INLAND STEEL

Airbriefs

By Henry Lowe Brownback

Valves

The design and building of gasoline engines has for years been a most interesting proceeding.. As higher speeds, compression ratios, supercharging and other aids to getting the most power out of a given piston displacement have been introduced one part after another in the engine structure has become critical. At first crankshafts broke, then valves burned out, piston rings failed and stuck, bearings went out, cylinder heads cracked, connecting rods failed, crankcases failed, and cylinder hold-down studs broke. As the failure of each part was corrected power was further increased and then some other failure showed up.

The most serious failure in the cycle and the hardest to lick has been the exhaust valve. Those of us who went through the early throes of aviation can remember the constant valve failures in the old engines and the very short valve life of the World War engines. The perfection of the stainless steel valve, then the salt cooled and sodium cooled valve seemed to be the answer. The failure of even these advanced materials and designs led to the coating of the valve seats, and sometimes the heads, with Stellite or some other very hard substance containing cobalt, nickel, tungsten or all of them and, in Europe, the chrome plating of valve heads to reflect heat rather than taking it in.

Most of this research was based on the theory that the valve faces and seats "burned." Lowering their temperature seemed to cure them for a time, but later they gave trouble. Intensive research showed that it was corrosion rather than true "burning" which was giving the trouble and that the temperature factor was one rather of accelerating corrosion than truly burning the metal. This has led to further research in metallurgy based upon heat accelerated corrosion of valve coating materials and the development of new alloys which could be used to coat valves and seats in order to give longer life. Remarkable results have been obtained in this work and the effective life of the poppet valve and its seat increased many times. True, the resulting valves are expensive and can be used only in engines where cost is secondary to performance, but certainly the ingenuity of man will find ways of applying these newer materials to lower cost valves and we may, some day, develop an engine which will run its whole life with no valve grinding and, if self adjusting tappets or rockers be used, without any valve adjusting.

Piston Rings

The major part of the engine at present which seems to need considerable research is the piston ring. True, advances made during the war have made rings better and given them longer life. Of course, piston rings which operate well in one engine may give trouble in another because of poor piston design or excessive oil passing by the bearings. I believe, however, that piston rings which have more or less automatic de-coking action and possibly with a good bearing metal on most of their surface will give results which will be astounding. It is my belief that piston rings are the greatest challenge to the builders of all kinds of engines today.

Small Builders

I can remember 'way back in 1912 or thereabouts many concerns launched plans for the building of airplanes to "fill the skys" with men who wanted to fly. The more ambitious projects were biplanes and the more popular ones small monoplanes—the Bleriot, Santos Dumont "Demoiselle" or Nieuport monoplanes, the last being a streamlined little ship which would still be a beautiful job. Many foreign engines were available and quite a few American jobs such as the Roberts, Eldridge, Fox and Emerson two-stroke and the Curtiss, Wright, Kemp, Albatross, Detroit Aero and several other more or less experimental jobs and a few rotary engines were available at prices ranging from about $300 to $5,000.

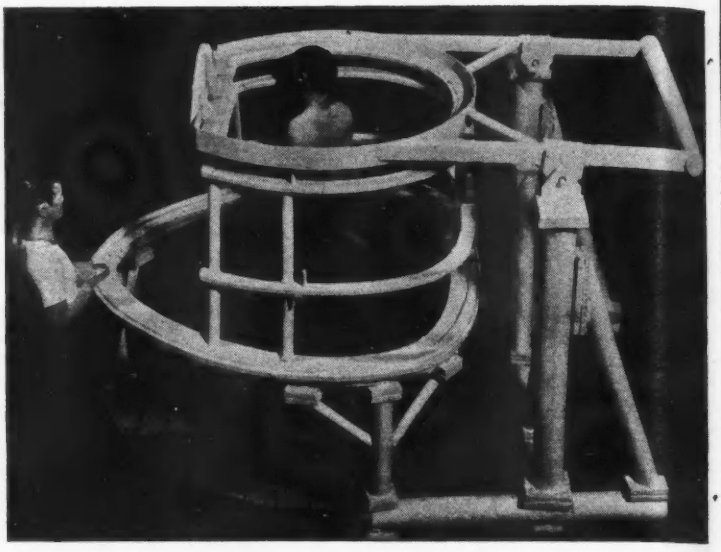
The plane builders, like motor boat builders, were for the most part just little shops with no sales or service organizations. The result was a "flop" in every sense of the word and aviation up until the World War boom was a losing game. After the World War the surplus sales of aircraft and engines gave the business a spurt which was greatly accelerated by the Lindbergh crossing of the Atlantic. One of the oldest publishers in the aviation field once stated to a noted British visitor that the writer was one of a little group which pulled small plane aviation through a bad spot just prior to this flight. Again the airplane field resembled, to a great degree, the boat business. The engine manufacturer had an investment and a few had service departments and some finances while the aircraft builders were individuals who could design a plane and make it in a little shop, but who could not finance the purchase of a few engines, but always talked about an order for a "thousand or two" shortly.

Prior to the late war but a handful of plane makers had gotten beyond this stage. When they got an order the "factory" ran and when they had no orders the factory closed down and whittled sticks. Unless there is some constructive thinking done very shortly the same thing is going to happen again. Some ambitious designer will hook up with a promoter who will sell some small town on the idea of tremendous "Ford-like" business which will be done in airplanes, get a small factory "on the town" and some local financing and a fancy name, then set sail. The average of these little plants after a few months, will fold up. It well behooves every man who wants to start in aviation to study the problems of national sales and service organization costs long before he thinks about an airplane design. The design problem is easy, the manufacturing at the beginning but little more difficult, but the sales and service organizing, the advertising and the footwork getting started and the cost of running an organization sufficiently large to ultimately succeed over the inevitable loss period is what will determine whether any venture can succeed or not.

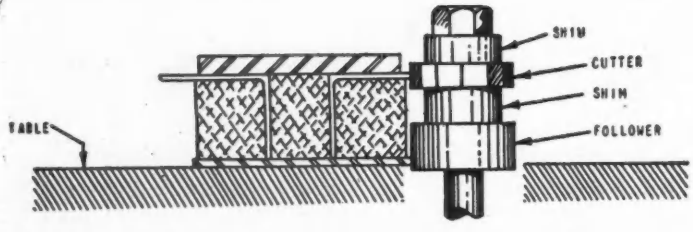
Fuel

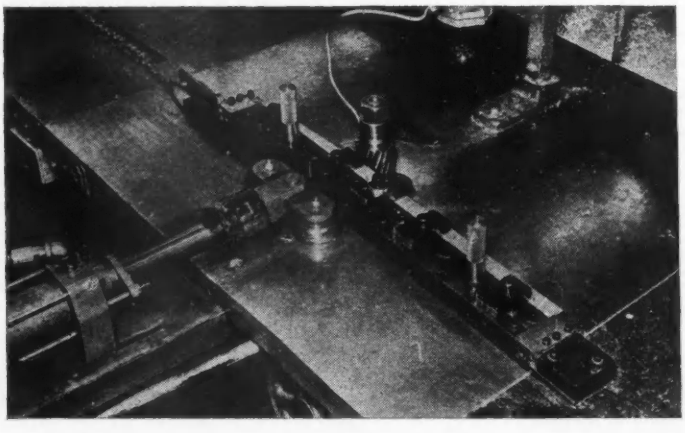
After the last war the Army made many experiments to determine just what caused crash fires. They ran old planes sans wings into a concrete wall and found that few fires could be traced directly to engine exhaust flame but came, rather, from hot pipes or sparks caused by friction. In the crash of planes with metal frames or tanks the friction can easily generate enough heat to fuse the metal and ignite the fuel. The two recent crashes of jet planes burning kerosene may have been caused by the open flame of the burners but could easily have come from the friction of the under-wing tanks on the ground. In a crash where the tanks are simply burst and the fumes get to the engine and flash back to the tanks fire might be reasonably attributed to the volatile fuel and the running engine but it is my opinion than any fuel which will run an internal combustion engine can be ignited by the friction of the crash landing of a high speed metal plane on a hard surface if the tank splits and gets fuel to the point of contact.

Short Cuts



So that each new assembly tool will have the most desirable physical characteristics, scale models of proposed jigs and fixtures are built at the Consolidated Vultee plant. The models are made from cardboard and wood, and their cost is said to be negligible in view of the fact that they eliminate the need for making full-size tools on an experimental basis. A scale model of a fuselage nose jig is shown in the photo.

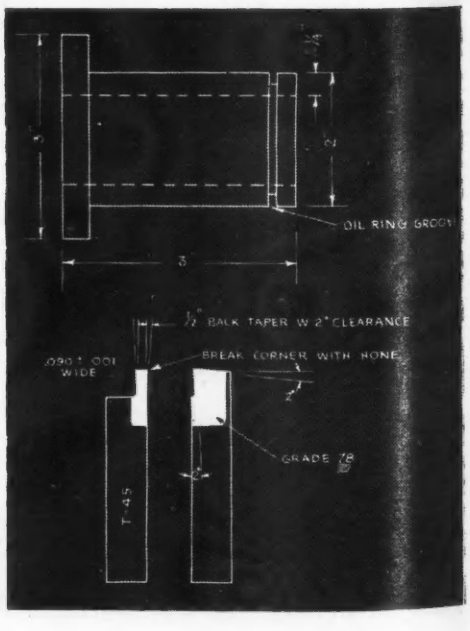




An increase in production of better than 500 per cent on trimming irregular edges of aircraft parts has resulted at Goodyear Aircraft Corp. through an adaptation of an attachment to a standard wood shaper to replace the hand fed method. The shaper consists of a flat table with a motor driven spindle projecting through its center, on which are mounted a cutter and a collar to act as a follower for the shaper block cut to the exact outline of the part to be trimmed. The power feed attachment includes an extension to the shaper table as shown in the photo. An endless roller chain is located in a groove in the top of this extension. The chain passes over sprockets at each end of the groove and returns underneath the table extension where it engages with a variable speed unit.

An air cylinder with a roller arrangement on the end of the piston rod is mounted on the front of the shaper table and in line with the spindle. A chain and hook assembly is attached to one end of each shaper block. In operation the hook is engaged in the roller which pulls the shaper block by the spindle. The air cylinder is actuated and the rollers hold the shaper block against the spindle with the proper pressure, adjustable with a regulator in the air line.

An inexpensive method for machining grooves in steel bushing was evolved recently by converting a standard right hand carbide tipped turning tool with a straight tip into a precision grooving tool. The bushing of SAE 4140 bar stock having a Brinell hardness of 290-310 had a groove .160 in. deep and .090 in. wide plus or minus .001 in. The tool with Grade 78 Carboloy cemented carbide tip was ground as shown here and then rotated 90 deg to cut the groove. A cutting speed of 350 sfpm was maintained with a .003 in. feed. The number of pieces between grinds rose from 12 by the former method to 125 with this carbide grooving tool.



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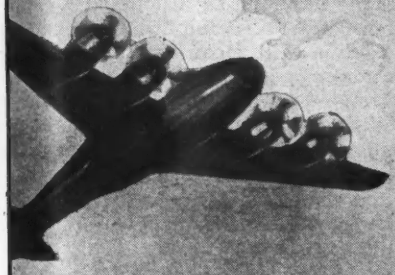

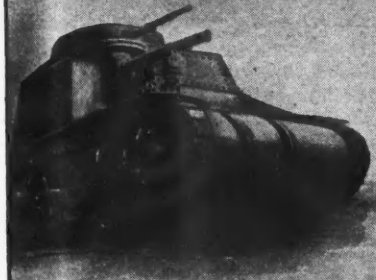

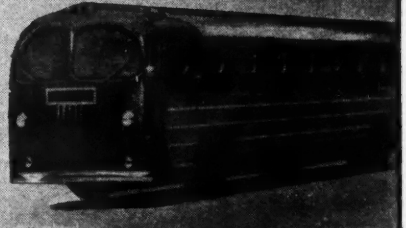

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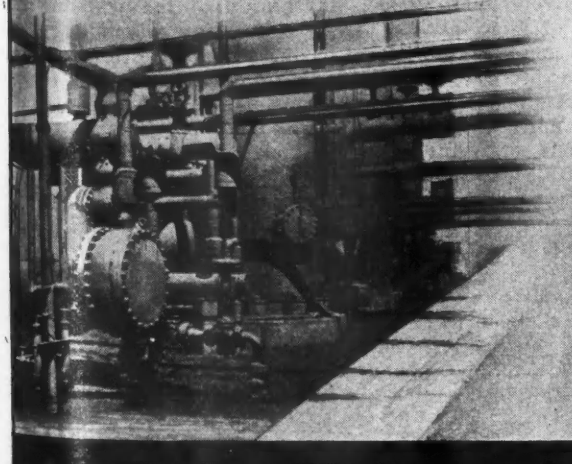

PERMATEX COMPANY, INC.
Sheepshead Bay, N.Y., U.S.A.

Labor Trouble Now Greatest Impediment to Reconversion

Except for Labor Strife, Reconversion Picture Is Fairly Bright. Chief Material Shortages Are in Fabrics and Tin

Labor trouble now appears to be the sand in the gears of reconversion. For the first few weeks after V-J Day the principal difficulty encountered was the inability to get committments of sheet steel in sufficient quantity to permit even a start on partial production of cars. That problem is being shoved farther into the background each day as mills pick up speed and it now is thought that the sheet and strip situation will be definitely under control by October or November at the latest. Tin and textiles still are in tight supply and may give some trouble, but the principal trouble now facing the industry is the fractious temper of organized labor.

Detroit in recent weeks has seen the paradoxical sight of thousands of men on strike at the same time that still greater numbers of persons are looking for work. That such a condition exists is testimony to the power which labor unions have built up during the last decade. The normal pressure of unemployment and a free labor market have been effectively neutralized by the powers of organization. It is significant to note that most of the strikes are over disciplinary action taken by management. That is why the temporary impediment to reconversion caused by sporadic stoppages is far less important than settling whether or not management shall have the right to manage its own business, an issue which is being fought out now. Upon the success which management achieves currently will rest the fate of labor relations in the months ahead. The industry has known for a long time that sooner or later it must stand on its fundamental rights to manage if full and efficient production is to be attained. Labor has made demands on Ford, General Motors and Chrysler for 30 per cent wage increases, but has made no move to assure them that workers will give at least prewar productive efficiency. Management is not concerned so much with increases in pay as it is in obtaining an honest day's work for a day's pay. That is the fundamental issue that must and will be settled.

Except for the dark clouds of labor strife, the reconversion picture is fairly bright. With steel becoming more abundant, the principal hitch in materials is textiles, with tin a close second. Chief difficulty in textiles is that WPB on Sept. 1 had not yet open-ended the textile orders which would allow the automotive industry to obtain goods on the same basis as other industries which have enjoyed preference ratings. As a result, mills could not fit automotive orders into schedules, and every day of delay in authorizing acceptance of orders from the industry might mean a week or more lost because intervening orders were piling in. It is understood that WPB has been delaying the open-end order at the insistence of OPA, which feels that some kind of control must be kept on the textile industry as a policing measure. However, it is felt that the textile situation will clear up fast, once the go ahead is given, and even though the normal time lag between the mill and the finished car is considerable, ways will be found to keep the pipelines filled.

The situation in regard to tin is ambiguous. From time to time, reports have been issued on the available supply and vary from 20,000 tons up to 80,000 tons. Although WPB has banned the use of tin in body solder, piston coatings, bearings and other parts, there is a general belief in the industry that restrictions may be eased somewhat before the end of the year.

(*Turn to page* 94, *please*)

Steel Shipments Threatened by Delay in Revision of Prices

Consumers of Flat Steels May Wait Until Middle of Year's Last Quarter for Delivery of Needed Material

By W. C. Hirsch

Up to the time of resumption of business following Labor Day, OPA had made no announcement regarding the upward revision of steel ceiling prices asked for by producers. This, together with the fact that the Controlled Materials Plan is not scheduled to expire until the end of September, makes for more marking of time at the very moment when the metal market's pace was generally expected to show definite signs of quickening. In spite of the dent in rolling mills' backlogs caused by cancellations of war contracts, many consumers of flat steels say they are unable to find a place on order books that will assure them delivery before the middle of the year's last quarter.

Labor disturbances in automotive plants, while without major effect on steel shipments because of conditions, nevertheless caused postponement here and there of commitments that otherwise would have come through. Some steel mills have had to pare down their output of primary forms of metal because of the lack of sufficient demand for finished steel. Cold rolled sheets are the one item in which the excess of what will be needed in the fourth quarter over the industry's capacity is so obvious that even conservative observers predict there will be a heavy carry-over of unfilled automobile sheet and strip orders to the first quarter of next year. On the other hand, cold finished bar orders have been reduced through cancellations to a point where new business is urgently needed to support anything like the wartime rate of operations. Not all military and naval business has come to a halt. Although there is little demand for the general run of shell steel, some of the tubular products specialists are furnishing sizable tonnages of cylinders to the Navy. It is expected that following termination of the Controlled Materials Plan some sort of limited procedure for insuring priority to certain products will be announced by WPB with little delay, but this innovation is likely to be much more simple than the soon-to-end system of rating and validation.

According to the *Wall Street Journal*, United States experts will be detailed to uncover whatever stocks of tin there may be in the hands of Japanese, whether in their occupied homeland or in the territories they had overrun during the war. It is generally felt in

(*Turn to page* 112, *please*)

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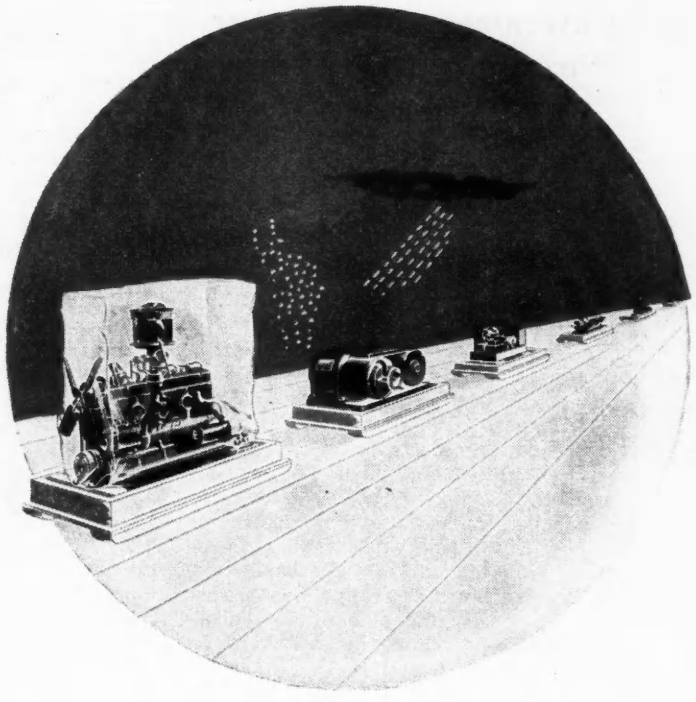

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Government Hold on Car Prices Seen Unnecessary

Government control of automobile prices in peacetime is not only unnecessary but highly undesirable, according to Geo. T. Christopher, president and general manager of Packard Motor Car Co. "The public always benefited from free competition before the war," the executive said. "The history of our industry has long shown the healthy effect of competition on car prices." No car manufacturer, he emphasized, would be foolhardy enough to set prices out of proportion with those of his competitors.

"Nobody's going to price himself out of the automobile field 18 months hence by trying to absorb reconversion costs immediately," Christopher pointed out. "We must take a long-range view and find a price basis fair to all. We must determine how many cars we must build a month to be on a profitable basis and then, project our production for a full season in order to determine a fair price structure. It's a job you can't do overnight."

Christoper, who directed production of approximately 57,000 Rolls-Royce aircraft engines and 13,000 Packard PT boat engines during the war, said the quick capitulation of the Japanese did not mean the public would get cars sooner, but more of them once production starts.

"At Packard, for example," he said, "we expect to produce about our original WPB quota of 8,000 cars during the last quarter of this year. Next year, though, it will be a different story. The pace will be greatly accelerated. We expect at least to double our quota of 58,640, building up to an annual production of 200,000 cars, a figure double that of our best pre-war years."

The automobile industry as a whole, he predicted, may turn out 4,000,000 cars in 1946, or double the WPB quotas, which since have been eliminated. The industry reached that figure only once—in 1929, when 4,587,400 cars were produced. Some people, he said, have the erroneous impression that engineering advances in the automobile of the future will be extremely rapid. "We put a lot more industry know-how into war production than we get back for peace-time production," Christopher asserted. "However, over a period of time we will be able to adapt to automobile building many of the things we learned during the war."

Christopher said factors outside the automobile plants are delaying the start of production and will confine the output temporarily. "Take steel, for example," he said. "There was plenty of steel on hand when the war against Japan ended, but it didn't include much low-carbon steel used in the manufacture of cars. "Let's put it another way. Elimination of red points wouldn't make more beef available. When materials become available in sufficient quantities, the increased production will result in great employment increases, in and out of the industry," he pointed out.

"Everyone," he concluded, "will benefit eventually, but it's going to take some time."

SAE Names New Board To Develop Postwar Engineering Program

Appointment of an SAE Technical Board of 23 high-ranking automotive engineers to coordinate and supervise all technical committee activities of the Society of Automotive Engineers has been announced by SAE president J. M. Crawford.

L. R. Buckendale, engineering vice-president of The Timken-Detroit Axle Co., Detroit, Mich., has been named chairman of the Board, which already has begun the work of converting the SAE War Engineering Program to peace-time service of industry and of government. Additionally, the Board will direct the development of a new cooperative engineering program designed to implement the request of Lt. Gen. Levin H. Campbell, U. S. Army Chief of Ordnance, for broadening and intensifying the war-time "functional teamwork" of SAE and Ordnance engineers to keep American motorized military equipment superior to that of potential enemies.

Appointment to the Board, President Crawford explained, is recognized as indicated prestige and accomplishment in various branches of automotive engineering. "Membership in the Board," he added, "is perhaps as great an honor as is within the power of the Society to confer."

First meeting of the Board, recently held, was concerned with plans for gradual transformation of the SAE War Engineering Program, involving more than 1,400 essential engineering projects and the cooperation of several thousand SAE members, into a coordinated peacetime program of tech-

(*Turn to page* 96, *please*)

PUBLICATIONS

The story of rayon's use in tires is interestingly told in a 16-page booklet, **Rolling on Rayon,** released by Industrial Rayon Corp. Sketches are used to explain the basic difference between rayon and natural fibers. Text and illustrations are used to tell how rayon is made and to describe in greater detail special methods of spinning, twisting, twist-setting, coning and weaving which are used in the production of Industrial yarn, cord and fabric.*

A new booklet called **Fitting the Steel to the Job** has been published by The Carpenter Steel Co. The 16-page booklet explains the uses and advantages of alloy steels **tailor made** to tool steel standards, to better meet special physical requirements and inspection standards. It gives information on selecting alloy steels to meet specific job requirements, such as **extra** fatigue resistance on parts exposed to extreme vibration, etc.*

The Torrington Co. has announced the publication of a new 153-page manual, a combined catalog and engineering and application data reference volume for designers and engineers, entitled **Torrington Needle Bearings.** It supplies all pertinent engineering information on various Needle Bearings, Types LN, DC, NCS and AT and RC. An illustrated section, with cross-section drawings, shows a wide variety of uses in equipment of aircraft, automotive, farm equipment, machine tool, material handling, etc. Specifications and tolerances, together with other informatory data, are included.*

The Rustless Iron and Steel Corp. has released an 84-page reference booklet, **Machining of Stainless Steels.** The purpose of the booklet is to make available to the metal trades the most up-to-the-minute information on the fabrication and application of the various grades of stainless steels. The data was prepared from actual production experience and laboratory research.

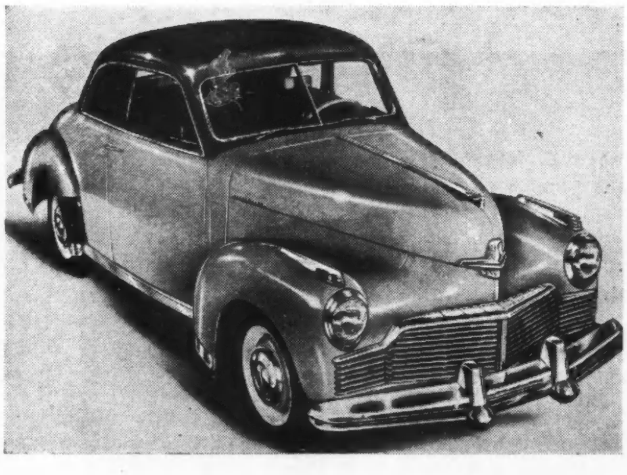
Cutting Gear Teeth on a Milling Machine is the title of a new booklet issued by The Cincinnati Milling Machine Co. It contains brief instructions on cutting worms and worm-wheels, and spur, helical and bevel gear teeth on a milling machine.*

A 170-page, pocket-size catalog and manual, **The Tool Steels of Allegheny Ludlum,** has been issued by Allegheny Ludlum Steel Corp. It provides a complete coverage of tool steels for all uses and users and contains many pages of technical data. It is well illustrated, contains a thumb-indexing and sectional arrangement and a general alphabetical index.*

A new bulletin, Bellows Air Motors, has been issued by The Bellows Co., describing its line of **reciprocating air motors.***

Michigan Tool Co. has issued an 8-page booklet, **Cone-Drive in Machine Tools.** Photographs and diagrammatic sketches

Studebaker Champion



Studebaker's offering in the lowest price field will be manufactured in four body types during 1945. Production schedules are said to promise a complete sampling of dealers within the next month. Styling follows the "Skyway" motif heretofore confined by Studebaker to its higher priced models.

Better than ever
after **VICTORY**

The largest and best facilities in all 34 years of Sealed Power history are now at your service. Our engineering and laboratory services have been greatly enlarged and improved to meet the emergencies of war work.

SEALED POWER CORPORATION
Muskegon, Michigan • Windsor, Ontario

Keep Your War Bonds! Get $4 for $3!

SEALED POWER PISTON RINGS

New X-ray equipment is used by laboratory technicians to check piston ring castings.

SEALED POWER PISTON RINGS

PISTONS — CYLINDER SLEEVES

indicate the wide variety of machine tools making use of the advantages offered by cone-drive double enveloping gearing and the manner in which the gearing is used to take advantage of its higher load capacity and greater compactness.*

A new catalog on **fractional horsepower drives** has been issued by The American Pulley Co. It contains price lists and specifications on the complete new line of F.H.P. Sheaves and Belts. It also contains several pages of condensed and simplified drive tables for a wide range of center distances and drive ratios. The American Pulley Co. has also released a new bulletin on pressed metal specialties, which describes and illustrates the facilities of the company to produce Precision Engineered **pressed-metal stampings, spools and reels.***

The first issue of a new Quality Control Bulletin, published by Physicists Research Co., describes a production instrument for the testing of completed ball bearings, called the **Anderometer.***

Colonial Broach Co. has issued a 4-page 2-color folder describing its improved standard line of **Pull-Down broaching machines.** A feature of the bulletin is a pictorial spread depicting Pull-Down machines at work, giving valuable hints on when to pull-broach.*

Formulas useful in calculating the weight of castings and definitions of terms used in materials testing are included in a 44-page illustrated catalog published by the Baldwin Locomotive Works, Cramp Brass and Iron Foundries Div. It gives the composition, applications, and complete physical properties of 32 of the brass, bronze and iron alloys most generally used in industrial and engineering applications.*

The Udylite Corp. has issued a new illustrated folder on **Buffs, Wheels and Compositions.** It describes and illustrates the various types of pocket buffs, polishing wheels and compositions offered by the company.*

Bulletin 27, describing and illustrating **Aluminum Cable Connectors,** has been issued by The Thomas & Betts Co. The complete story of T & B Aluminum Pressure Connectors is told in the bulletin and several pages are devoted to laboratory testing results and photographs of standard and tailor-made installations showing the effective use of these new T & B Aluminum Connectors.*

A colorful new brochure containing information and technical data on stainless **strip steels** has been released by Superior Steel Corp. It is illustrated and describes properties, compositions and applications of various types and grades of stainless steel. Technical tables on each type of stainless strip steel, physical and mechanical properties of certain metals and alloys, and a table on weights of steel strip are included.*

* Obtainable by subscribers within the United States through Editorial Dept., AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

1946 Hudson

***Orville Wright** and **Col H. Nelson Jackson**, honor guests, photographed as they discussed the first 1946 Hudson as it came off the line. Col. Jackson was the first man to cross the continent by automobile in 1903.*

Army-Navy "E" Award Program Is Terminated

The termination of the Army-Navy "E" Award program, by which the War and Navy Departments recognized outstanding contributions to the war effort by industrial plants, was announced by Under Secretary of War Robert P. Patterson and Assistant Secretary of the Navy H. Struve Hensel. Awards granted at the August meetings of the Army and Navy Boards for Production Awards will be presented, but no further meetings of the Boards will take place.

The Army-Navy "E" Award came into existence in July of 1942 when the Navy "E," the Army "A," and the Army-Navy Munitions Board Star Award were merged. Since that time, the award has been granted, according to an estimate based on various statistical reports, to approximately five per cent of the Nation's war plants.

Advertising Note

West-Marquis, Inc., Los Angeles and San Francisco agency, has been retained to handle the advertising campaign which is shortly to be launched by Harlow Aircraft Co., Alhambra, Cal.

Army Ordnance Report on Production of Tanks and Trucks Sept. 1, 1942, to Sept. 1, 1945

Class	Last 4-Months of 1942	1943	1944	First 8-Months of 1945	Total
TANKS: Thirty-four models including the "Locust" light airborne tank, "General Chaffee" light tank, the "General Sherman" medium tank series, and the "General Pershing" heavy tank series.	12,661	29,584	21,700	14,428	78,373
SELF-PROPELLED WEAPONS: Thirty-one models such as the "Slugger," "Priest" and "Hellcat," tank-destroyers, the 155 MM gun motor carriage M12, the M10 gun motor carriages, and half-track multiple gun motor carriages.	4,120	21,194	12,792	5,583	43,689
MISCELLANEOUS COMBAT VEHICLES: Thirty models including such vehicles as prime movers, Tank Recovery Vehicles, the Armored Cars M8 and M20, the Scout Car M3A1, the "Weasel" cargo carrier series, and the personnel-carrying half-tracks.	9,660	52,094	35,839	16,037	113,630
LIGHT AND MEDIUM TRUCKS: Eleven sizes ranging from the ¼ ton "Jeep" to the one and one-half ton trucks.	135,837	389,257	329,369	178,413	1,032,886
LIGHT-HEAVY TRUCKS: Nine types "workhorse of the Army" two and one-half ton trucks.	69,032	193,380	221,302	150,639	634,353
HEAVY-HEAVY TRUCKS: Twenty-seven models ranging from 3 ton through the 20 ton Tank Transporter.	9,363	37,208	50,608	33,360	130,539
OTHER VEHICLES & MISC. ITEMS: Twenty-seven different semi-trailers; 33 models of trailers; 18 different machine gun mounts; 22 models of tractors and tractor cranes; also armored cabs, bulldozers, bicycles, passenger cars and motorcycles.	76,993	543,629	241,932	154,093	1,016,647
TOTAL	317,666	1,266,356	913,542	552,553	3,050,117

How To Make Your Tools & Dies Produce EXTRA Pieces On Each Job...

Getting tools and dies that produce more pieces on each set-up isn't a matter of luck. Here's a practical way to get *extra output* from each tool by reducing machine down time. Use this 3-step *job analysis* plan to save money in tool making, heat treating and all along the production line.

1. Plan Tool Performance At The Start

Here is a tried and proved way to get the extra output you want from your tools. With the Carpenter Matched Set Method you can actually plan tool performance before tools are made. For example, when you need greater toughness or more wear resistance in a tool, the Matched Set Diagram points to the tool steel best suited for the job. To cash in on its advantages ask for the 167-page Matched Tool Steel Manual. Its handy index quickly shows the way to the proper tool steel to meet your needs. For your free copy, drop us a note on your company letterhead.

2. Follow Up With Heat Treating "Know-How"

You know that proper heat treatment will back up your work in making tools that stay on the job. And here is how Carpenter can help you get better heat treating results. The Carpenter Heat Treating Guide provides complete, correct heat treating information in easy-to-use form. It gives you forging and normalizing heats, annealing and hardening treatments, recommended drawing ranges for all of the Matched Tool Steels. It gives tips on quenching, drawing and furnace atmospheres. For tools that will stay on the job longer and produce extra pieces, ask for your free Heat Treating Guide.

3. Check Each Tool's Output On The Job

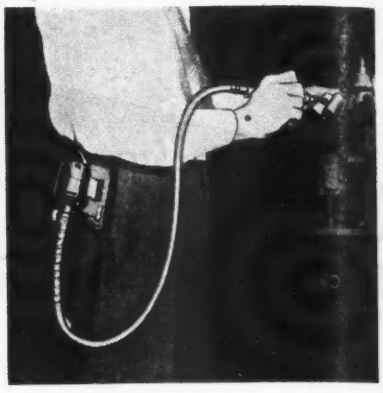
How many pieces does it produce between grinds? Did it fail too soon in service? Answers to those questions give you a yardstick to use in boosting output from each tool. Start today to check tool and die performance for more output, lower costs. And whenever you want personal help with a tooling problem, call your nearby Carpenter representative. He'll be glad to work with you.

The Carpenter Steel Company
103 W. Bern St., Reading, Penna.

Carpenter MATCHED TOOL STEELS

New Production Equipment

WYZENBEEK & STAFF, INC., Chicago, Ill., offer the Wycoflex "Universal" high-speed grinder in three models for light, medium and constant duty service. Model No. 00-U has a ¼-hp universal motor with a free speed of 16,000 rpm. The Wyco flexible shaft is 4 ft long with a ¼-in. core. The precision collet handpiece takes ⅛-in. and ¼-in. collets. Model No. 000-U2 is 1/10 hp and has a free speed of 18,000 rpm. The flexible shaft is 3½ ft long and has a ⅛-in. core. The ball-bearing collet handpiece takes ⅛-in. and 3/16-in. collets. Model No. 000-U1 has a free speed of 15,000 rpm, and uses the same flexible shaft and collet handpiece as No. 000-U2.

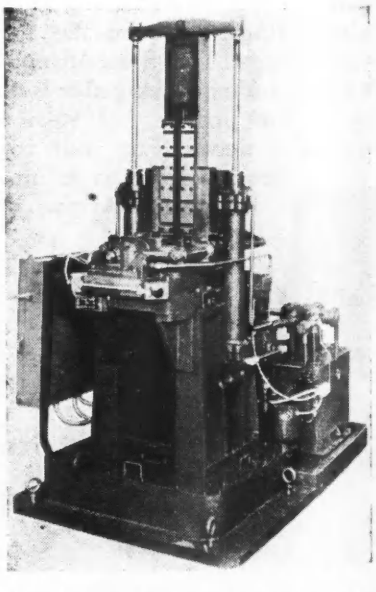


Wycoflex high-speed grinder

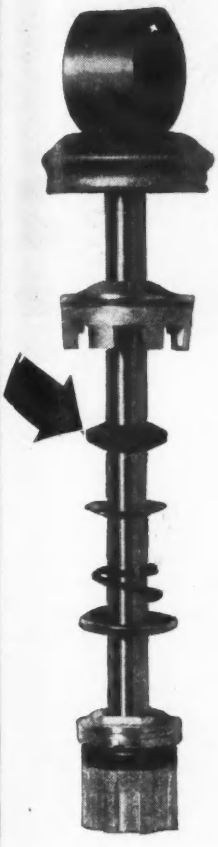
A SPECIAL purpose machine for broaching the I-D and split-line surface of automatic type precision half-bearings, has been completed by Hydraulic Machinery, Inc., Dearborn, Mich. The cycle of these vertical type machines is entirely automatic except for loading and unloading.

Advantages of this special purpose machine are high production, positive alignment and clamping of bearings, adaptability to different sizes of nests for various sizes of bearings and adjustable broaching speed. These machines are powered by a Hy-Mac hydraulic power unit. The cycle of the machine is accomplished by hydraulic sequence valves, solenoid operated four-way valves, pressure switches, limit switches and a special electrical control panel. The movement and locking of the nest block is accomplished by special cylinders built into the nest

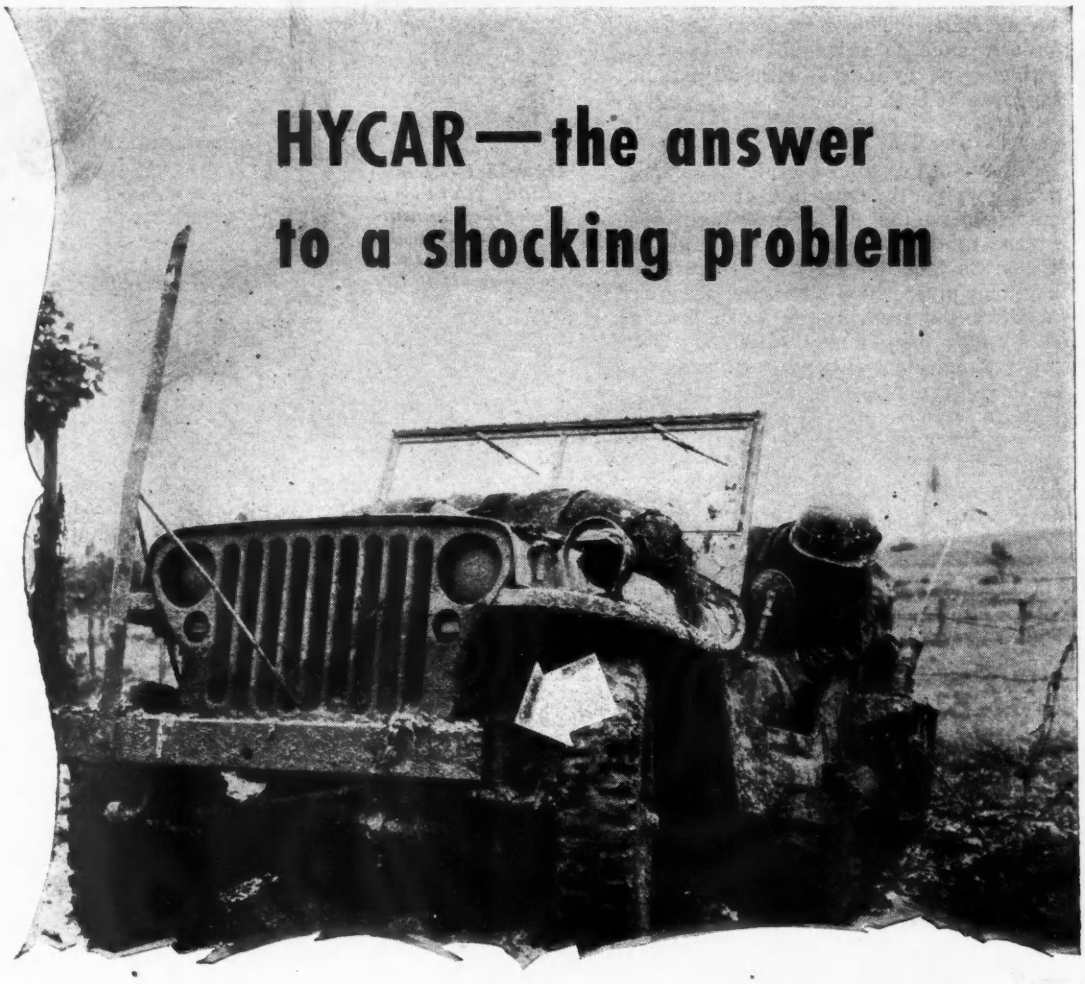
(*Turn to page* 50, *please*)



Special machine for broaching precision half-bearings



HYCAR—the answer to a shocking problem



Hycar parts by Ohio Rubber Co

WHEN a new, light weight shock absorber was developed for use on jeeps, Gabriel Company engineers were faced with the problem of finding something they weren't sure existed. The whole performance of the new device depended on a resilient sealing ring that had to last the life of the unit while soaked in hydraulic oil. No provision could be made for repairs or replacement.

Obviously the ring had to be oil resistant—must not shrink or swell or change shape, or the oil would leak past. It had to *stay* resilient to maintain a perfect seal. It had to stand the heat developed by the piston making 100 strokes per minute. It had to stand the abrasive action of that same motion against the piston wall.

The problem was to find a material with that exact *combination* of properties. Many materials had one or more of these qualities. But Hycar synthetic rubber was the only one found to have exactly the *right* properties in the *right* combination.

As a result, thousands of these shock absorber seals have been made from Hycar and are working perfectly on jeeps and other vehicles.

Listed in the box at the right are the important, basic properties of Hycar that have dictated its use in this and many other difficult industrial applications. Check these properties against your requirements for mechanical rubber products — then ask *your supplier* to furnish you Hycar parts for test in your own service. You'll find that it's wise to use Hycar for long-time, dependable performance. *Hycar Chemical Co., Akron 8, Ohio.*

CHECK THESE SUPERIOR FEATURES OF HYCAR

1. *EXTREME OIL RESISTANCE—insuring dimensional stability of parts.*
2. *HIGH TEMPERATURE RESISTANCE—up to 250° F. dry heat; up to 300° F. hot oil.*
3. *ABRASION RESISTANCE—50% greater than natural rubber.*
4. *MINIMUM COLD FLOW—even at elevated temperatures.*
5. *LOW TEMPERATURE FLEXIBILITY—down to —65° F.*
6. *LIGHT WEIGHT—15% to 25% lighter than many other synthetic rubbers.*
7. *AGE RESISTANCE—exceptionally resistant to checking or cracking from oxidation.*
8. *HARDNESS RANGE—compounds can be varied from extremely soft to bone hard.*
9. *NON-ADHERENT TO METAL—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)*

Hycar

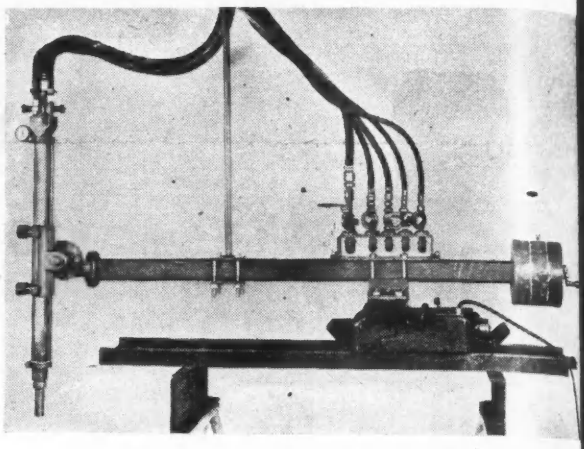
Reg. U. S. Pat. Off.

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubbers

block slide. The movement of the broach slide is accomplished by two swivel type cylinders with adjustable cushions at both ends.

A HEAVY-DUTY, oxy-acetylene cutting blowpipe, the Oxweld C-45 machine-cutting blowpipe, has been brought out by the Linde Air Products Co., Unit of Union Carbide and Carbon Corp. This new blowpipe, which cuts steel ranging in thickness from 16 in. to 50 in., is said to be particularly suited for hot top cutting, ingot slitting, riser cutting, cutting large forgings, and scrap cutting in many applications where the oxygen lance was formerly required.

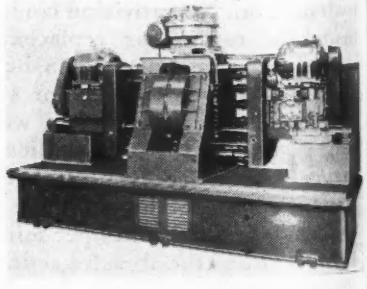


Oxweld C-45 machine cutting blowpipe mounted on an Oxweld CM-21 cutting machine

The C-45 is water cooled and is i tended to be mounted on a heavy-du straight-line cutting machine such the new Oxweld CM-37 machine or t Oxweld CM-21 cutting machine. A 5 lb gage is attached to the blowpipe bo for checking cutting-oxygen pressur which are unusually low—never ov 35 psi. The C-45 blowpipe is design for operating with medium-pressu acetylene and will operate satisfactori on a generator or a manifold having minimum hourly capacity of 500 cu of acetylene.

Also available is the Oxweld C- blowpipe holder, which has been desig ed especially for this blowpipe. Vert cal adjustment is obtained by turning ball crank which operates a worm an gear that meshes with the blowpip rack. A total angular adjustment 135 deg can be obtained in the plan of the cut.

SNYDER TOOL AND ENGINEERING Co Detroit, Mich., has designed an built a special-purpose, double-end ma chine for hollow milling one or tw trunnions on converter blades of variou shapes and sizes.



Snyder special double-end machine

In this machine, two Snyder self-con tained hydraulic units and multipl heads and an electrically driven fixtur trunnion with holding jaws, are assem bled on a welded steel base. The cool ant tank is in the rear of the base. Too spindles are guided in the trunnion sid members and are equipped with preci sion end stop adjustment to maintai accuracy and depth of cut. The trunnio

(*Turn to page* 70, *please*)

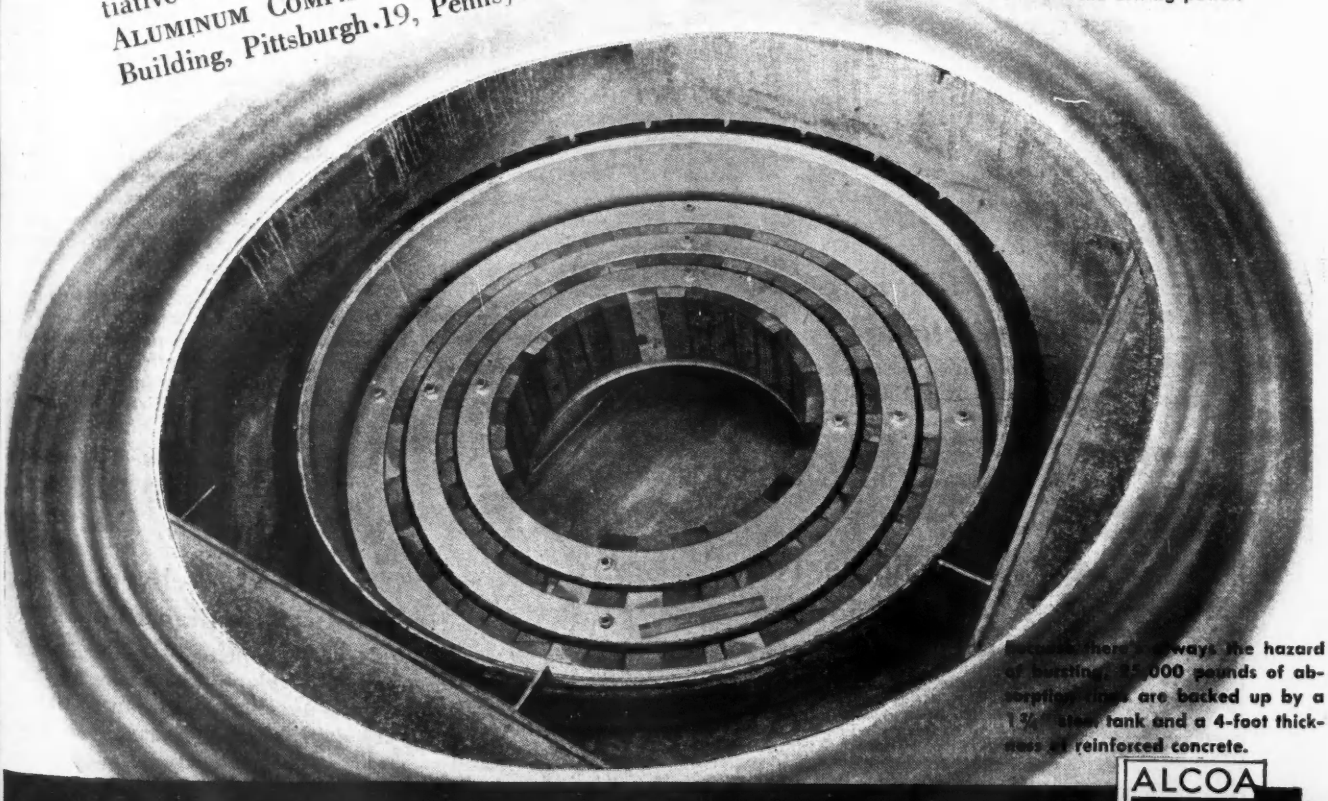
ALCOA'S NEW

"Whirl pit"

CAN RUN FASTER THAN SOUND

Are rotating parts of engines to run at higher speeds? Will gas turbines place new demands on metals? Let an engine builder ask for aluminum pieces to handle those assignments and Alcoa is ready. Alcoa foundries and forge plants will produce those parts according to their designers' wishes. Then into the whirl pit they go, to be rotated at speeds which may go as high as 60,000 r.p.m. (Pieces five feet in diameter can be tested.) Stress-coat lacquers measure centrifugal stresses, permitting redistribution of the metal to improve performance. With this new whirl pit, Alcoa KNOW-HOW takes another big step forward, again displaying the initiative which has kept ALCOA First in ALUMINUM. ALUMINUM COMPANY OF AMERICA, 2110 Gulf Building, Pittsburgh 19, Pennsylvania.

Lowering an Alcoa Aluminum impeller into the pit for centrifugal testing. It is run in a vacuum to reduce the driving power.



Because there always the hazard of bursting, 85,000 pounds of absorbing rings are backed up by a 1¾" steel tank and a 4-foot thickness of reinforced concrete.

ALCOA ALUMINUM

ALCOA ALUMINUM

New Products for Aircraft

New GM Aircraft Engine

A new aircraft engine, rated at 200 hp has been developed by the Research Division of the General Motors Corp.

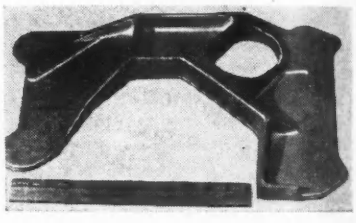
Designed for installation in private air cruisers of the future, the engine is an outgrowth of studies started eight years ago and subsequent war contracts —in connection with the development of military robot planes. It has undergone extensive flight testing for six years.

The new engine is a 4-cyl. radial type and operates on the two-cycle principle. Its unique feature is that a supercharging blower is used to increase performance and power reserve for take off a altitude. There are no valves, this fun tion being performed by the pistons. A though the piston displacement is on 250 cu in., it develops 200 hp with high safety factor. The weight dry 275 lb. It is probably the only small e gine having liquid cooling and may b installed for the same weight as an ai cooled engine. It is only 35 in. in d ameter.

Oil consumption is a quart of oil fo six hours running. Fuel consumption comparable to engines of similar pow er, about thirteen gallons an hour usin 91 octane fuel.

Market potential and productio studies are now being conducted by th Buick Motor Division of the Corpora tion.

Large Forging of Strong Aluminum Alloy



Pictured here is an aircraft part forged from R303, the new Reynolds Metals Company's strong Aluminum alloy. It is said to be the largest forging yet to be made from an aluminum alloy of such high strength.

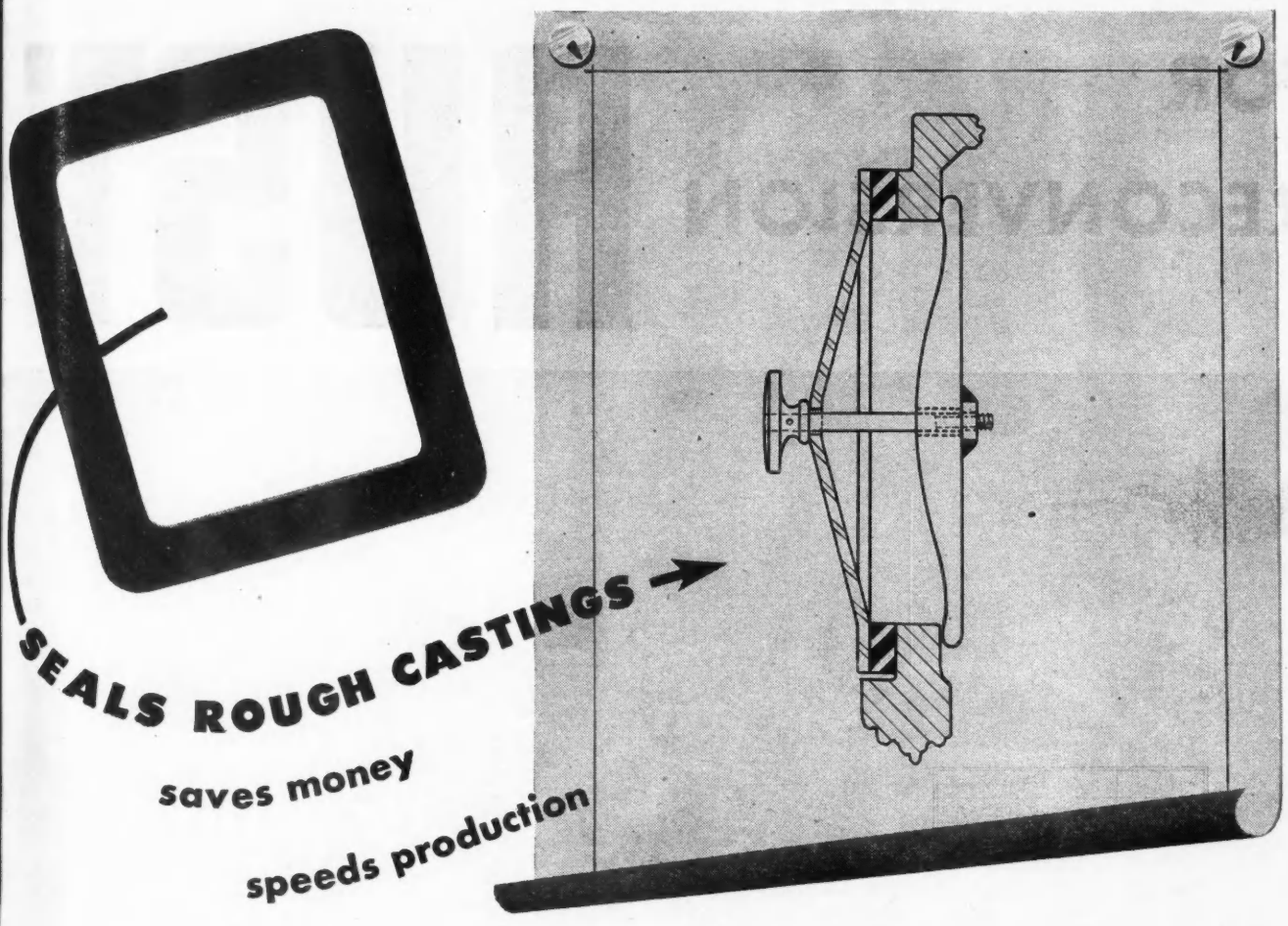
The usual specified tensile strength for aluminum commonly used in forging aircraft parts is 65,000 psi. R303 provides a tensile strength as high as 85,000 psi, a strength increase of approximately 30 per cent.

Use of R303 alloy in such forged parts allows for a reduction in the size of the part in proportion to the increase in strength. There is also a reduction in weight, an all-important factor in aircraft construction.

The part illustrated was forged on a 12,000-lb hammer from 3¼ in. round stock.

Taylorcraft Delivers Postwar Civilian Plane

The first delivery of a postwar c vilian airplane was made by Taylor craft Aviation at Alliance, Ohio, jus 14 days after V-J Day. The plane, side-by-side two seater, rolled off 1,000-ft production line, a method manufacture hitherto unused in peace time aircraft construction. It was 65-hp, BC12-D model, with a cruisin speed of 95 mph. The selling price $2295, unchanged from the prewa price despite many improvements an additional equipment.



YOU now can cut machining operations on cast flanged surfaces and still produce a positive seal . . . with Armstrong's NK-730. This new cork-and-synthetic-rubber composition is cushion soft and truly compressible. Thus it conforms easily to the normally uneven surfaces of rough cast or stamped flanges. It seals tightly under light assembly pressures with virtually no side flow on unconfined edges.

Despite its softness, Armstrong's NK-730 is a tough material, highly resistant to solvents, oils, and salt water. And because it is resistant also to the effects of sunlight, heat, and aging, it is lastingly resilient.

Armstrong's NK-730 is a money-saving, production-speeding material. It can be used effectively and profitably for low-pressure sealing on products as varied as electric motors, diesel engines, and aircraft assemblies. It is ideal for sealing coverplates of all kinds where alignment of internal parts is not involved and temperatures do not exceed 250° F.

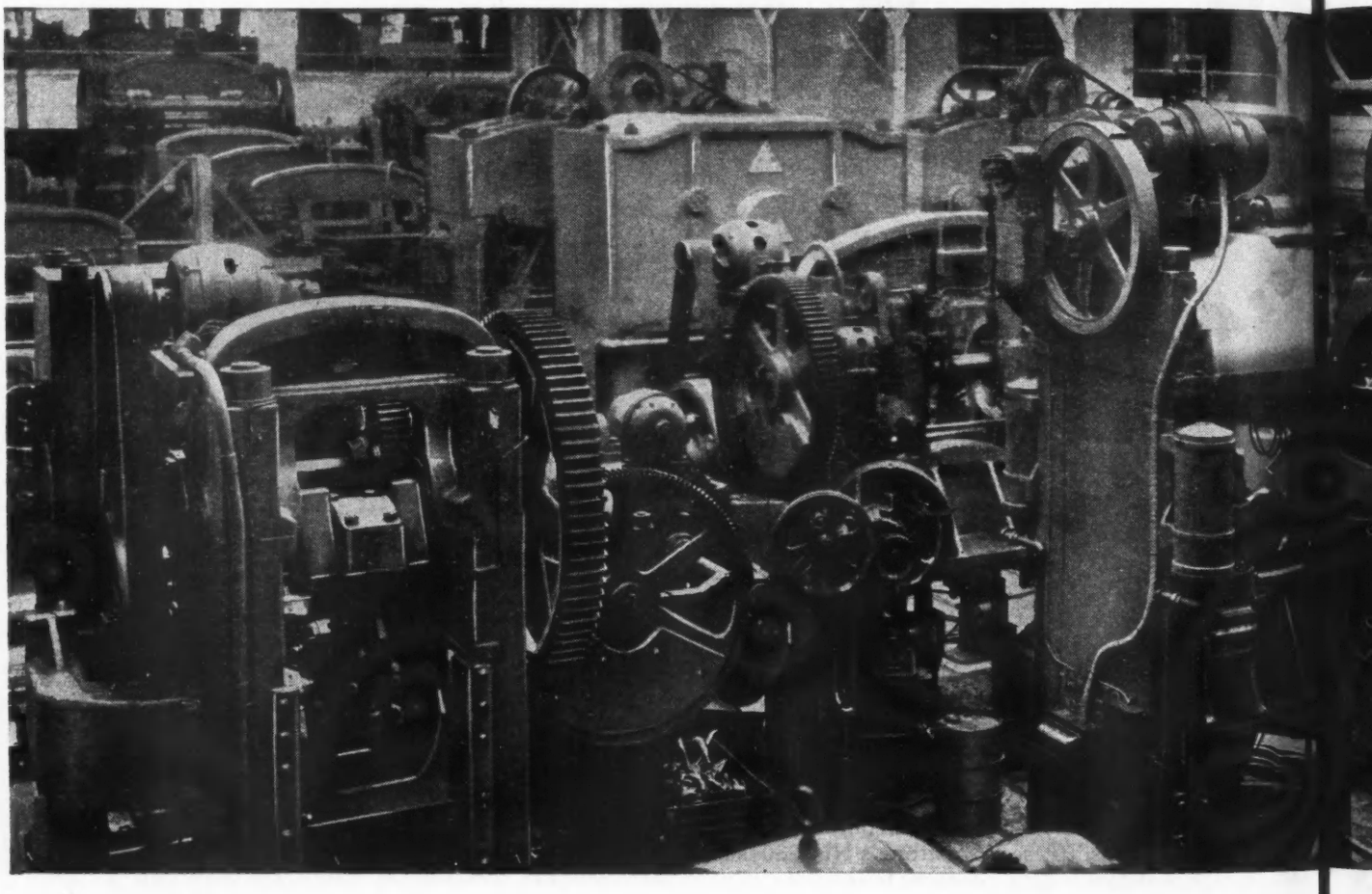
An Armstrong Gasket Engineer will be glad to call and help you fit NK-730 into your production plans. Or send us working drawings and details and we'll submit suggestions and samples. Besides NK-730, Armstrong supplies many types of specialized sealing materials to industry. These include cork compositions, synthetic rubber compounds, fiber sheet packings, and rag felt papers. Equally broad is our experience in solving sealing problems. This experience is yours to use freely. There's no obligation, of course. So write us today. Ask, too, for a copy of our 12-page specifications booklet, "Gaskets, Packings, and Seals." Address Armstrong Cork Company, Gaskets and Packings Dept., 1509 Arch Street, Lancaster, Penna.

MATERIALS AND SPECIALTIES FOR AIRCRAFT AND AUTOMOTIVE UNITS

- **Gaskets, packings, seals,** piston cups, bushings, and valve seats—for gauges, fuel lines, meters, hydraulic systems, and other equipment
- **Composition roll goods,** with or without fabric back, plain or adhesive-coated—used as glazing strip, binding tape, cushion pads, anti-skid flooring, and gaskets
- **Tank strap cushions**
- **Sealing materials** for specialized aircraft equipment handling aromatic fuel
- **Felts** for vibration-damping and soundproofing
- **Wingwalk materials**
- **Resilient floorings**
- **Carburetor floats** and other fabricated natural or composition cork specialties

ARMSTRONG CORK COMPANY

FOR RECONVERSION RUST



WHETHER reconversion of your plant to peacetime production is sudden or gradual, one of your first chores will have to be the rustproofing and processing of Government-owned machinery, tools and other production equipment scheduled to go into storage. This must be done, *with minimum delay,* in accordance with Ordnance Instruction P.S. 300-4.

A stock of suitable Texaco rustproofing products on hand will greatly facilitate your compliance with this requirement, and speed your changeover to civilian production.

Texaco rustproofing products meet Ordnance specifications, and are easily applied by brush, dip or spray. The

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON EVERY SUNDAY NIGHT —CBS

TEXACO

TEXACO

PROOFING

protective coating they provide will assure preservation for years.

Whatever your rustproofing requirements, a Texaco representative can render helpful service. Get in touch with the nearest of more than 2300 Texaco distributing plants in the 48 States, or write to The Texas Company, 135 East 42nd Street, New York 17, N.Y.

REMEMBER...

1. Upon termination of war contracts, Government-owned production equipment must be rustproofed promptly, in accordance with official instructions.

2. Ordnance Specification P.S. 300-4 contains official instructions for the complete processing of such equipment.

3. These instructions require that only rustproofing materials meeting Government specifications be used.

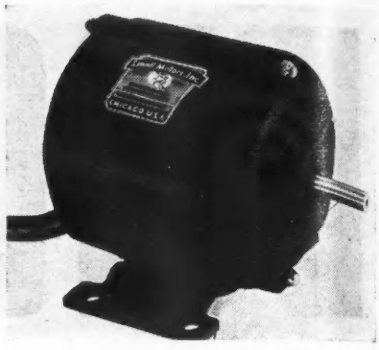
4. Texaco rustproofing products meet Ordnance specifications for application on Government-owned equipment.

Rustproofing Products

New Products

Fractional Hp Motors

Small Motors, Inc., Chicago, Ill., is introducing a series of SM-30 capacitor-start induction motors. These motors are 3⅞ in. in diameter, 3⅞ in. high and 4⅞ in. long, plus shaft extension. The capacitor is approximately 2 in. in diameter by 4 in. long. Various capacities are available, from 1/70 to 1/25 hp. In addition to the capacitor-start induction type, these motors are built also in split-phase and shaded-pole types. Speeds are 3350, 1725 and 1150 rpm in capacitor and split phase, or 3100 and 1550 as a shaded-pole motor. Motors are furnished with ball bearings or oilless sleeve bearings, and are wound for standard power supply voltages up to 460 volts.

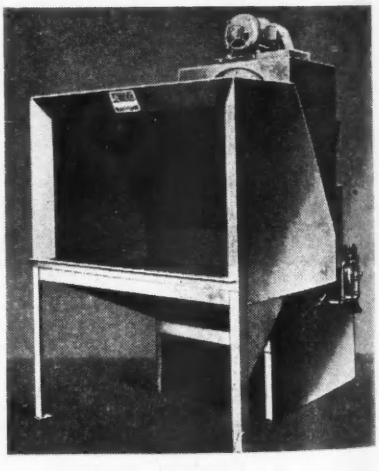


SM-30 motor

Metal Spray Booths and Dust Collecting Equipment

Designed and built especially for handling sprayed metal dust, a complete line of metallizing spray booths and dust collecting equipment has just been released by the Metallizing Engineering Co., Long Island City, N. Y.

The line includes spray booths for exhausting to present exhaust systems, to the atmosphere, or into a Metco wet collector. Featured in the line is a lathe exhaust unit which is mounted directly on the lathe carriage and moves with it. Also featured are wet collectors and water wash spray booths which gather metal particles in a sludge sump where valuable dust may be reclaimed for salvage.



Metco spray booth

Metco spray booths include advantages such as sloping rear wall that eliminates eddies and recirculation, open type work table, down draft, dust trap and cleanout door.

Flexible Stainless Hose

The Carpenter Steel Co., Welded Alloy Tube Division, Kenilworth, N. J., is producing flexible stainless steel hose for applications where flexible connections are required between movable

(*Turn to page 58, please*)

TOUGH

Baker Hydraulic
Bulldozer made by
Baker Manufacturing Co.
Springfield, Illinois

When an air strip is needed in a hurry . . . or a pillbox is to be demolished . . . the call is for a Bulldozer. In the present war these sturdy earth movers have earned their chevrons along with tanks, guns, planes and ships. Most fighting units class them as indispensable.

The Baker Bulldozer is a good example. In war and in peace they deserve their well earned reputation for being TOUGH. They do their work fast . . . efficiently . . . and keep right on doing it day in and day out. One reason why Baker Bulldozers deliver such excellent performance is that they are equipped with Johnson Sleeve Type Bearings.

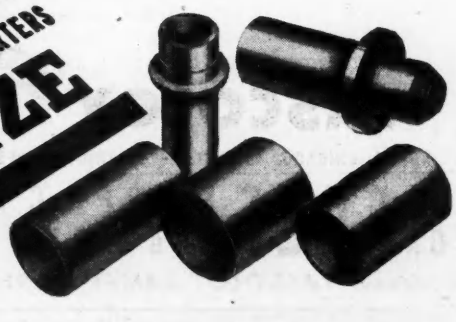
Helping manufacturers of all types of equipment to build superior performance into their product is a welcome assignment for Johnson Bronze. When you need advice on any type of bearing application, consult with *Sleeve Bearing Headquarters.*

JOHNSON BRONZE CO.

625 S. MILL STREET NEW CASTLE, PA.

BRANCHES IN
18 INDUSTRIAL
CENTERS

JOHNSON
SLEEVE BEARING HEADQUARTERS
BRONZE



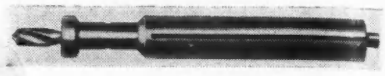
Flexible stainless steel hose made by Welded Alloy Tube Division of Carpenter Steel Co.

parts, or where vibrations are set up between two rigidly held units.

Manufactured from stainless steel tubing of various analyses, the hose can be used also for flexible steam connections, flexible conduits for wiring and intricate connections on lines carrying corrosive fluids.

Drill Protector

A drill protector that reduces drill breakage and provides two other features—depth gage and stop—is just being placed on the market by Hartwell Engineering Co., Los Angeles, Cal. Its principal use will be among users of



"Protector & Depth Gauge"

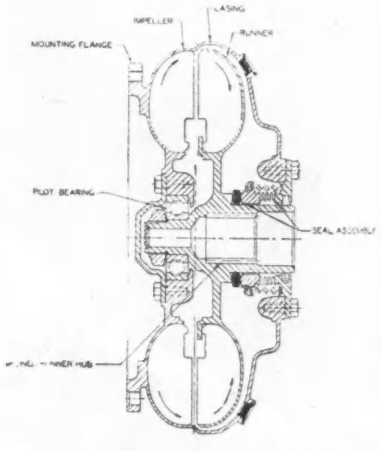
breast or hand drills, and portable power-driven drills.

Two dimples in the nose of the "Protector & Depth Gauge" fit into the drill flutes and drive the drill. Power is thereby applied close to the point of the drill, instead of at the shank, eliminating stress on the drill shaft.

The shank of the protector is slotted to permit the chuck to grip the drill with sufficient pressure to lock it at any desired depth setting. Its rounded nose protects drilled surfaces and serves as a stop.

Improved Fluid Drive

The American Blower Corp., Detroit, Mich., has announced a new and improved line of fluid couplings—the Gyrol fluid drive. Intended for industrial applications and for use with internal combustion engines for heavy duty power, the Gyrol line is suitable for motor trucks, locomotives, earth moving machinery, oil drilling equipment, marine installation, etc.



Schematic cross-section of the Gyrol fluid drive

The automotive type couplings will be available in a range of sizes from 12 in. to 27 in. diameter; and ranging in torque capacity from 20 to 2000 lb ft. These should encompass the full range of automotive type engines for all purposes. Whereas the early units were machined from castings, bolted together to make the assembly, the Gyrol coupling fluid drive is a light-weight assembly of stamped vanes and pressed castings welded into a high strength unit. Since the outer casing is welded to the impeller shell there are no gasket joints under contrifugal pressure.

(*Turn to page 60, please*)

Hansen

MODERN *STREAMLINE* COUPLINGS

SAVE TIME! • SAVE MONEY! • SAVE MATERIAL!

Hansen Couplings are streamlined for speed, ease of operation, low cost and peak production. To meet tomorrow's keen competition short cuts in production have to be made in the way of time saving on production, man hour savings and savings in material.

Hansen Couplings save all along the line because they are simple and easy to install and to operate. Take for instance the Hansen Push-Tite air coupling, a slight push of plug into socket, coupling is connected and air is automatically turned on. To disconnect operator merely slides sleeve back with thumb, plug is ejected and air is automatically turned off. Operator connects and disconnets air line right at his bench, no wastage of his time going back and forth to connect or disconnect or to turn air on or off. Full swivel action prevents kinking of hose.

Hansen Couplings will handle pressures up to 10,000 pounds without leaking, saving considerable volume of air which is costly.

Hansen streamlined couplings are far in advance of the field and cut down operating time and cost while boosting the production volume. Send for the Hansen industrial catalogue—it's free.

THE HANSEN MANUFACTURING CO.

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The runner stamping is integral with the splined runner hub. This makes it possible to connect with the driven member of the power line simply by slipping a splined shaft into the assembled unit. Dis-assembly is just as simple. The seal assembly at the rear and the anti-friction bearing at the front end can be readily removed, independently from each end, without disturbing the main assembly or its alignment.

With the fluid drive installed in a truck, full torque can be applied with the wheels at stand-still in any gear ratio, so that the load can be accelerated in whatever gear ratio suits the grade. The efficiency of the fluid drive and transmission combined is above 90 per cent throughout most of the operating range and above 95 per cent in the ratios where the majority of driving takes place. The development of a constant mesh transmission to be used with this fluid drive will open new fields of application for engines where steam and electric drives are being used.
Caption for cut x 12 on 13 1-2 slug

Water-Saving Coupling

Latest product of E. B. Wiggins Oil Tool Co., Los Angeles, Cal., is an industrial hose coupling of aluminum with only two moving parts. The new two part aluminum unit includes a threaded end section that applies on a standard threaded faucet and a ring equipped section for application in the end of a length of hose. The ring is pulled back by a spring, moves axially over a set of hinged dogs. It is knurled to provide an operating grip.

Moving the ring back against the spring permits the dogs to swing open and clear a holding ring integral on the shank of the section applying on the faucet. Releasing the ring after the two coupling sections have been brought together, closes the dogs inward to grip the ring and hold the assembly together. The shank on the faucet section rides inside a rubber gasket in the ring section to prevent leakage at normal hose pressure. Two sizes are available—⅝ in. and ¾ in. standard.

Indicating Snap Gage

Federal Products Corp., Providence, R. I., has recently added the Model 1340

(*Turn to page* 114, *please*)

Federal model 1340 snap gage

"Fluid and Flexible"... *he says*

THAT, ZHUKOV, is also the battle cry of manufacturers using Arc Welding to win business victories.

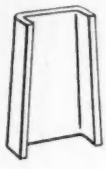
WHEN THE SALES DEPT. SAYS:

"We've got to trim the cost of our product or get trimmed in the field."

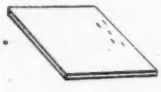
THEN THE SHOP DEPT. SHOULD REPLY:

"O.K., let's go after parts such as this 95¢ cab support—

1 Cut a plate and bend into a channel so . . .



2 Cut a base plate so . . .



3 Cut 3 braces so . . .

4 Use a stud so . . .

5 Assemble the parts in a jig and weld

Total cost of welded steel support, 52¢ . . .

SAVING 43¢ each."

The Lincoln Engineer nearby will gladly help you develop your strategy along the fluid and flexible lines of welded design. Studies in Machine Design free on request. Ask for them on your business letterhead.

THE LINCOLN ELECTRIC COMPANY • Dept. Z-1, Cleveland 1, Ohio

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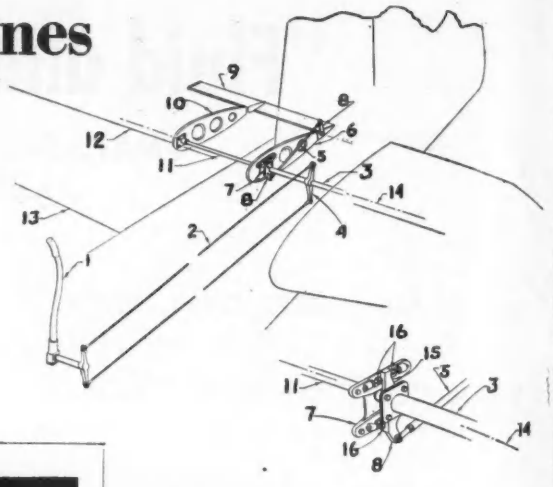
ARC WELDING

Boost Tab for Light Airplanes

Shown here are details of a control surface boost tab developed at Consolidated Vultee. It is simple and greatly reduces the control forces required to operate an airplane and prevents performing maneuvers at accelerations above a safe value. In operation, if no appreciable resistance is encountered in moving the elevator, the torsional spring will not deflect and the elevator will be actuated in direct proportion to the movement of the control stick. If resistance is encountered in moving the elevator, the torsional spring will deflect, allowing a relative movement between the main torque tube and the elevator. The linkage between the torque tube and tab enables the tab to be displaced so that it will facilitate the elevator movements. The amount of deflection and assistance is determined by the force applied to the control stick; which may be varied in accordance with the strength of the torsional spring and tab linkage. The positions of the stops determine the extent of tab deflection. The illustration shows the application of the boost tab on a BT-13 trainer.

1—Pilots control stick
2—Cables
3—Main torque tube
4—Elevator control horn
5—Tab control rod
6—Inboard elevator rib
7—Stop support bracket
8—Horn
9—Boost tab
10—Elevator rib
11—Torsional spring
12—Stabilizer
13—Elevator
14—Hinge line
15—Stop arm
16—Screws



Application of the boost tab on a BT-13 trainer

Allegheny Ludlum Steel Corp. to Expand

A $5 million postwar research and production expansion program has been approved by the Board of Directors of the Allegheny Ludlum Steel Corp. An ultra-modern research laboratory and related experimental and pilot plant equipment will be built at company headquarters, Brackenridge, Pa., to intensify studies of the structure, melting, processing and further development of high alloy steels.

At the West Leechburg, Pa., plant will be constructed a cold rolling mill of latest design, for rolling stainless and silicon strip steels, that will add materially to the capacity of the plant.

New Detroit Office For Vascoloy-Ramet

The Detroit branch office of the Vascoloy-Ramet Corp. of North Chicago, Ill., is now installed in new quarters at 512 Book Building. The move was made in order to secure more room for a branch organization expanding in step with increased deliveries and to provide a more central, downtown location.

Stainless Steel Manifolds

(*Continued from page* 32)

mine if the condition of the material is at fault. As yet, we have been unable to show that excessive carbide precipitation or inter-granular corrosion, or a combination of both, has any effect upon service failure which could be attributed to the conditions of electrolytic corrosion.

Tests were run on columbium and titanium-stabilized material for the purpose of determining the effect of carbide distribution on corrosion resistance. For consistency of purpose, all tests in each group were run on the same heat of material. The specimens were processed in the following manner: (1) Gas and arc weld samples were heat treated for various times at different temperatures. Half of the samples were sensitized. (2) One production part was sectioned which contained both gas and arc welding. Samples were taken and processed in similar manner to the above. (3) All samples of both the sensitized and unsensitized types were immersed in the copper-sulfate-sulfuric acid solution (Strauss tested). The period of immersion was 48 hr. (4) All samples were cross-sectioned for microscopic examination. (5) Carbon and stabilizing element ratios were obtained on the materials tested and are as follows: Columbium stabilized-carbon 0.07 per cent, columbium 0.88 per cent; titanium stabilized-carbon 0.078 per cent, titanium 0.376 per cent. All of the arc welds proved to be satisfactory in resistance to carbide precipitation and intergranular corrosion. Therefore, it appears that there is no need for post welding heat treatment of arc welds for any reason associated with carbide precipitation.

The gas weld of type 347 (columbium-stabilized) shows better resistance to corrosive attack by electrolytes than that of type 321 (titanium-stabilized) in Fig. 5. These were treated, for two to three minutes at 1650 F for stress relief. It might be well to explain here that the Ryan Aeronautical Co. uses titanium-stabilized grade of 18-8 for manifold use only when the columbium grade is not available, and consequently we have insufficient actual service data to show relative service results.

However, other manufacturers of exhaust manifolds use titanium-stabilized steel almost exclusively and do not employ the stabilizing heat treatment for their products. Therefore, for the purposes of comparison, both grades are treated in this article as having the same end result in exhaust manifold use.

The bend tests on the weld zone after embrittlement tests required in Specification AN-QQ-S-757 proved to be more satisfactory than was expected. All but one sample, which cracked during preparation, withstood bending 180 deg over a diam equal to twice the thickness of the material, which was 0.043 in. Compression failures on the inside of the bend radius were noted in all specimens.

The results of the tests conducted have been crystallized into a conclusion that has an important bearing upon the serviceability tests for stainless steels and indicates that more research is needed in this field. This conclusion is that stabilizing treatment obtained by heating welded sections of 18-8 types 321 and 347 stainless steel for 30 minutes at 1650 F exerts some small, but inconclusively beneficial results in one respect of minor significance—resistance to attack by corrosive aqueous solutions and electrolytes. There appears to be no justification for assuming that any substantial and practical benefit will be obtained by applying this type of heat treatment to aircraft exhaust manifolds. This conclusion has special significance when it is realized that aircraft exhaust manifolds encounter no environment in service as corrosive as the copper-sulfate-sulfuric acid solution.

Aside from the metallurgical considerations, there are some manufacturing problems which would add to the

(*Turn to page* 68, *please*)

cost of the finished product by heat treatment at 1600 F. The scale that is formed at this temperature is very tight and thin. Removal of this scale by the usual acid pickling solutions is not readily accomplished. This results in added costs because of sandblasting or special pickling solutions which must be used. It would be necessary, too, to increase furnace capacity for heat treatment at this temperature for the desired length of time—namely, a minimum of a half hour, instead of the usual annealing heat treatment time of from 10 to 15 min. Another manufacturing problem, which is not as serious as far as increase in cost is concerned, is the question of warpage on the finished part caused by this heat treatment.

It has long been known that the presence of precipitated carbides tends to raise the yield strength of the material when tested at room temperature. From this knowledge the question of increasing the yield strength under high temperature operation by the deliberate precipitation of carbides has at times been raised. Recently, a limited number of tests by other investigators (Miller, Benz, and Day—"Transactions" of the ASM, Vol. 32, 1944, pp. 380-407) have indicated that at the elevated temperature 1100 F, stress creep strength is lowered from 10 to 20 per cent by this stabilizing heat treatment. These results would tend to bear out the theory that a small amount of carbide formation along grain boundaries and slip planes within the austenite grain would enhance the strength of the material at elevated temperatures. Data such as these may be a more important factor in determining the service life of an exhaust manifold than any actual corrosion of the material due to exhaust gases.

Serious considerations are in order to establish the allowable amount of chromium carbides, without the danger of inter-granular corrosion, for the enhancement of the high temperature strength of the material. Factual data along these lines are lacking in detail but are proven in substance by the tens of thousands of exhaust manifolds which have been manufactured in the last eight years on which no stabilizing heat treatment has been given.

Helicopter Design

(*Continued from page 33*)

The high speed of helicopters is largely a function of the parasite drag, power loading and tip speed ratio. For example, helicopters which have relatively-high parasite drag, as in present stage of development, may be expected to have speeds vs. power loading in the neighborhood of the values given in Table I:

Table I

Power Loading T/Hp*	Approx. Top Speed (Ft per sec)	Estimated Cruising Speed (75 per cent of Top Speed)
8	205	154
10	190	142
12	175	131
14	160	120
16	145	109

* Power loading is based on power supplied to the rotor.

From Table I is may be seen that the power loading to the rotor is a determining factor for the cruising speed of the helicopter; therefore, a power loading may be selected based on cruising speed requirements.

While little is known of the efficiency of helicopter rotors in forward flight some information is available for the efficiency of autogiro rotors in forward flight, and there is reason to believe that helicopter efficiencies in forward flight will be similar to those obtained for the autogiro.

GM Unfilled War Orders

General Motors Corp. had more unfilled war orders on the books at the end of the war than any other of the 321 corporations with war work at the end of hostilities, according to a Securities and Exchange Commission report. G.M. unfilled commitments amounted to more than $2.5 billion.

Adaptability

Michigan Welded Steel Tubing

SIZES: ¼" to 4" O.D.
GAUGES: 9 to 22

Available in commercial mill lengths or cut to specified lengths, shaped and fabricated ready for assembly.

Michigan welded steel tube can be flanged, expanded, cold drawn, fluted, flattened, bent, coiled, upset, beaded, grooved, rolled, spun, threaded, tapered, and shaped to meet every manufacturing demand.

Engineering advice and technical help in the selection of tubing best suited to meet your needs.

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DISTRIBUTORS: Steel Sales Corp., Detroit, Chicago, St. Louis, Milwaukee and Minneapolis—Miller Steel Co., Inc., Hillside, N. J.—C. L. Hyland, Dayton, Ohio—Dirks & Company, Portland, Oregon—James J. Shannon, Milton, Mass.—Service Steel Co., Los Angeles, Calif.—American Tubular & Steel Products Co., Pittsburgh, Pa.—Strong, Carlisle & Hammond Co., Cleveland, Ohio—C. A. Russell, Inc., Houston, Texas—Drummond, McCall & Co., Ltd., Toronto, Canada.

New Production Equipment

(*Continued from page* 50)

is indexed station to station by a Ge eva index mechanism mounted on top o the trunnion assembly.

Parts are located in the jaws b means of two side locating plates. Eac fixture has an individual hydraulic cy inder which automatically clamps th part while the fixture indexes from loa ing station to first working station.

Each index station has three fixture holding three parts, each of which identically machined at the same time

The work-cycle consists of an inde followed by the tool work and is semi automatic, requiring the operator t press a button after loading thre pieces. Unloading is automatic.

Work parts of various shapes an sizes are accommodated by exchangin the holding jaws on the fixture and ad justing the side locating plates. Produc tion is 575 units an hour at 80 pe cent efficiency.

A NEW Centri-Meco centrifugal castin machine has been placed on th market by Centrifugal Machine an Engineering Co., Kalamazoo, Mich This machine which features th Miracle-Hub—a trade name—has been designed to be heat-free in the bearing area during continuous use with perma nent molds attached directly to the heavy table mounting-plate. This new type hub is said to be so constructed

Centri-Meco centrifugal casting machine

that the temperature in the bearing area never exceeds 125 F. The heavy table has four strut-vanes which act as a fan to carry away the excess heat that is radiated above the top bearing.

Two-speed Centri-Meco centrifuga casting machines, and variable-speeds are obtainable. Equipped with certain mechanical drives, infinitely variable speeds are provided from 198 to 1290 rpm with a 2-hp motor, or with 3 hp an increased range of variable speeds from 301 to 1959 rpm. Electronic drives may be installed on custom-built machines where greater ranges of higher or lower speeds than these are needed.

(*Turn to page* 74, *please*)

Pilots, Gyro Flight Instruments, Magnetos, Motors.

Far... HOW SOON?

Buy More War Bonds and Stamps

other products have flowed from Jack & Heintz plants in ever-increasing numbers. And always, the aim of our engineers has been to give more than was wanted—to be forever a little ahead of the needs of the plane manufacturers and the demands of the government.

This policy of leadership has guided us in the design and testing of several important new products not yet announced. We believe they will contribute a great deal to further advancement of aviation . . . just as Jack & Heintz products have done in the past . . . that they will help prove that literally, the sky's the limit.

Watch Jack & Heintz for better things for flying.

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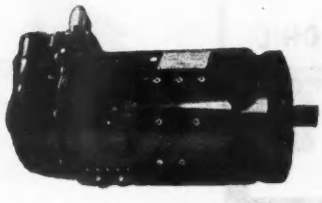
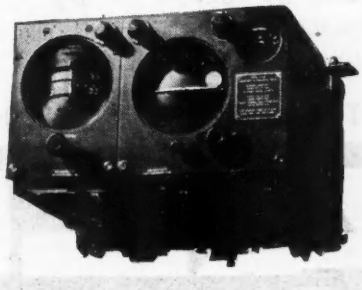
BEARINGS



GENERATORS



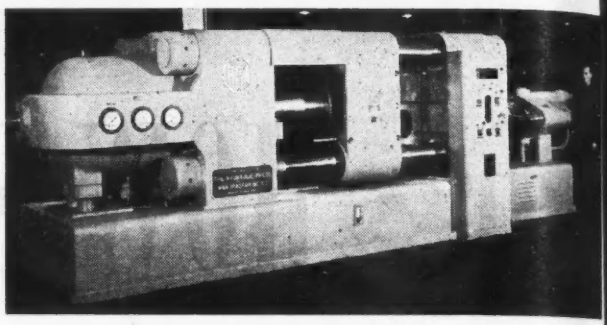
AUTOMATIC PILOTS

New Production Equipment

(*Continued from page 70*)

THE Hydraulic Press Manufacturing Co., Mount Gilead, Ohio, has completed one of the world's largest high-pressure die casting machines. This massive "all-hydraulic" machine is designed to cast 14.88 lb of aluminum alloy per "shot" at an injection pressure of 25,000 psi. This weight represents a casting volume of 154½ cu in.

Specifications of this new H-P-M high-pressure die casting machine are as follows: Mold clamp pressure, 1000 tons; maximum mold mounting space, 31 in. by 56 in.; maximum daylight opening between mold mounting surfaces, 48 in.; maximum mold clamp travel, 24 in.; injection stroke (maximum), 18 in.; electric motor, 100 hp; shipping weight, 103,4[illegible] lb.



H-P-M high-pressure die casting machine

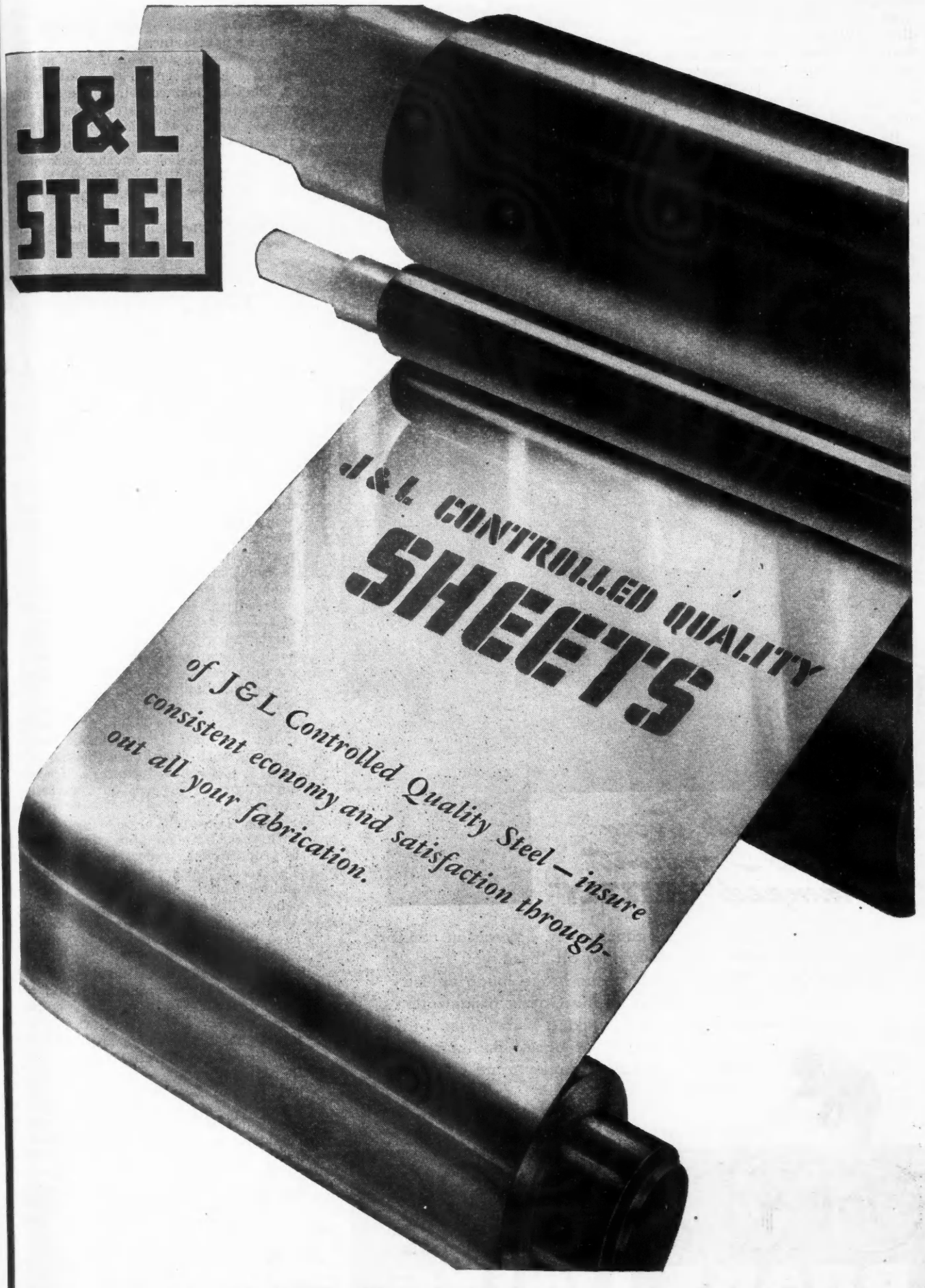
The machine is of the same basic design as H-P-M's standard model 400-A die casting machine, only larger in size. Both mold clamp and injection plunger are actuated by direct hydraulic means. The machine is powered by two H-P-M Hydro-Power radial pumps, directly connected through flexible couplings to a 100-hp double-end-shaft motor. Machine is completely self-contained. Only connections required to put machine in operation are electric power and cooling water. Movable mold clamp platen is equipped with hydraulic ejector. Operating system is designed for installation of hydraulic core pulls.

BARRETT EQUIPMENT Co., St. Louis, Mo., is introducing a new portable brake drum lathe for field service work or in locations where time and labor can be conserved by bringing the lathe directly to the job.

The outer end of the lathe shaft rests on a steadyrest, or outboard support to prevent off center deflection of the shaft because of the weight of the object being machined. The lathe on its adjustable stand, together with the

(*Turn to page 76, please*)

Barrett portable brake drum lathe



JONES & LAUGHLIN STEEL CORPORATION • PITTSBURGH 30, PENNSYLVANIA

steadyrest, are arranged on a rubber-tired wheeled track to permit easy handling. When track is placed on the floor, the wheels are raised from contact, thus giving firm support for the lathe and its work. The floor and track arrangement, not the lathe shaft, support the weight.

Built on the principle of the internal boring bar, the lathe has a range of swing from 7 in. to 24 in., is equipped with rheostat speed control and operates on 110 volts, alternating or direct current.

Although designed primarily for automotive use, the Barrett portable lathe should be found economical in industrial plants where a machine for internal machining, grinding and honing can be brought to the job.

JESSOP STEEL CO., Washington, Pa., has developed a new composite tool steel known as Type R, for use in chipper knives, planer knives, paper knives, and blades for cutting light sheet metal.

The fatigue and shock to which these tools are subjected limits the carbon content of the tool steel that can be used.

In the Jessop process, of which they have exclusive control, flat bar stock is formed by diffusion welding high speed steel to a backing steel of low alloy content. The tool steel portion of the composite bar stock extends from the edge of one flat surface to within ¼ in. of the centerline and consists of approximately 40 per cent of the total gage.

This method combines the hardness and edge holding properties of high speed steel in the tool, with the shock resistance of the low alloy steel. Also, the slots and holes in the back of the knives can easily be machined through the low alloy portion to the center of the bar.

Jessop Type R is available in standard sizes in even inches from 2 to 10.

Measure of Hardness

(*Continued from page* 35)

perature at which maximum hardness is reached.

Figs. 1B and 2B show the same evaluation for the Al-Cu-Mg alloy. Except for a few differences, the conditions were the same as with the Al-Mg-Si alloy. With Al-Cu-Mg there is proportionality between hardness and resistance in the cold-aged condition from 400 to 520 C. Fig. 2B gives additional information on the important question regarding the manner in which an overheating of the alloy is made manifest. The resistance-hardness curves show an inflection above 500 C; resistance increases without a further rise in hardness. The inflection point indicates the limit up to which the alloy can be heated without danger of partial liquefaction. The highest permissible annealing temperature is thus ascertainable from the conductivity. It must be established beforehand for each alloy; once this has been done, it is possible by means of a conductivity test to pick out overheated samples.

Figs. 1C and 2C also show that with the Al-Mn-Zn alloy the hardness is proportional to electrical resistance. The results with the three alloys examined lead to the conclusion that the relationship between hardness and electrical resistance applies to all cold-aged aluminum alloys; but only in the cold-aged condition.

Fig. 3 shows, for a cold-aged sample, the change in resistance and hardness with reference to the annealing temperature. It is obvious from this figure that the development of the two qualities is not parallel. The method therefore is not—or only restrictedly—applicable to heat-aged alloys.

In Fig. 4 it is shown that the increase in the hardness is variably proportional to the increase in conductivity, though it is nearly so for the Al-Mg-Si and Al-Mg-Zn alloys. In the case of the Al-Cu-Mg alloy, on the contrary, the increase in hardness is greater at the lower quenching temperatures than at the higher, while the change in resistance is equal. Worthy of note is the much greater increase in resistance of the Al-Mg-Zn alloy as compared with the others.

Nash Front Suspension

(*Continued from page* 23)

slotted and has two oil holes—one for feeding the drilled passage in the rod for lubricating the wrist pin, the other communicating to the outside of the rod forging so as to spray the cylinder walls. Other improvements include helical-type oil pump gears and an oil seal on the ignition distributor shaft to prevent crankcase oil from working its way up into the breaker box.

The Ambassador engine is 6-cyl, valve-in-head type, 3.375 in. bore by 4.375 in. stroke, 234.8 cu in. displacement, rated 112 hp at 3600 rpm, 6.8 to 1 compression ratio. (In 1942 this engine was rated 105 hp at 3400 rpm with 6.4 to 1 compression ratio.) Valve noise has been reduced by the adoption of single springs which eliminate high speed vibration and by the use of safety clips added to the valve stem. Helical gear type oil pump is standard. Oil flow to the cylinder walls and piston pins has been more than doubled.

The main and countershafts of the "600" transmission now are on 3.0 in. centers instead of 2.5 in., thereby decreasing bearing and tooth loads. Both shafts are increased in diameter and replaceable bronze thrust washers are fitted at each end of the countershaft. A spiral groove in the rear countershaft bushing acts as a pump to force oil through the front bushing and thrust washer, providing positive pressure lubrication. The Ambassador transmission also has the benefits of detail improvements.

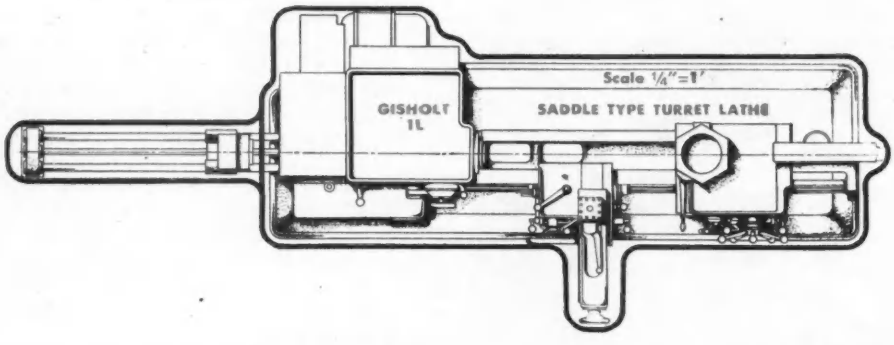
Clutch action has been improved on both models. On the Ambassador, clutch throwout shaft oilers have been added. On the "600," clutch and brake pedals are provided with long lubricated sleeves in the hubs to prevent wear and to eliminate side wobbles. On both models cushion springs beneath the clutch facing are stiffer to permit more gentle engagement. The linkage between the clutch pedals and throwout shaft has been improved on the "600," eliminating chatter under certain conditions; also reducing pedal pressure. Pedal pressure is further reduced on the "600" with the new linkage system which gives an over-center effect.

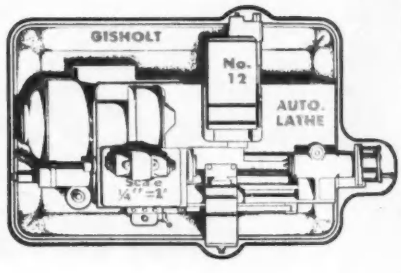
At the rear of the chassis the driveshaft split coupling threads are tapered and chased to permit the clamping nut to be turned far enough to assure tightening the coupling on the splines (see Fig. 2). A hex is provided on the front end of the coupling so the shaft can be prevented from turning while the nut and coupling are being tightened.

The rear axle has a new seal and drain at the wheel bearings to prevent oil leakage into the brake drums. The rear track bar is more rugged and is provided with rubber bushings at each end to afford a more rigid positioning of body and axle.

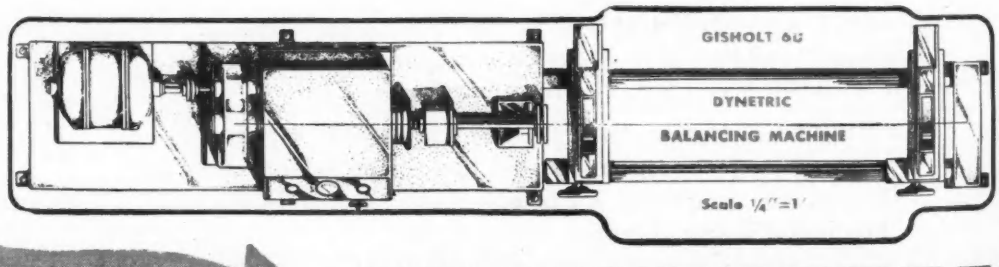
PLANNING NEW PLANT LAYOUTS FOR TOMORROW?

Gisholt is ready to assist with cardboard punchings for each size and type of Gisholt machine. These models—each made to exact scale—enable you to plan the location, or re-location, of machines by simply placing them upon your projected factory floor layout sheets to obtain the most efficient arrangement of machines, more easily. They are available, free of charge, upon request, to all companies preparing for reconversion to peacetime production. Use the coupon below.





The three diagrammatic cut-outs shown here represent the Gisholt 2L Saddle Type Turret Lathe, the No. 12 Hydraulic Automatic Lathe, and the 6U Dynetric Balancing Machine. Made precisely to ¼ inch to 1 foot scale, they eliminate the need for special trips to the shop to obtain accurate measurements of actual machines, or tedious checking of catalog specifications. Similar cut-outs are now available on all sizes and types of Gisholt machines.



USE THIS HANDY COUPON to request models desired

Be sure to indicate the quantity required for each size and type of machine. All requests should be directed to Madison.

GISHOLT

TURRET LATHES

AUTOMATIC LATHES

BALANCING MACHINES

SPECIAL MACHINES

GISHOLT MACHINE COMPANY

1205 East Washington Ave. • Madison 3, Wisconsin

Look Ahead—Keep Ahead—With Gisholt Improvements in Metal Turning

Gisholt Machine Company
1205 East Washington Ave.
Madison 3, Wisconsin

Gentlemen:

Please send me, free of charge, diagrammatic cut-outs of Gisholt Machines as indicated below. (Please state number required for each.)

__ No. 3 Ram Type Turret Lathe	__ Simplimatic (Automatic) Lathe
__ No 4 Ram Type Turret Lathe	__ No. 12 Hydraulic Automatic Lathe
__ No. 5 Ram Type Turret Lathe	__ 1S Dynetric Balancing Machine
__ 1L Saddle Type Turret Lathe	__ 3S Dynetr c Balancing Machine
__ 2L Saddle Type Turret Lathe	__ 3U Dynetric Balancing Machine
__ 3L Saddle Type Turret Lathe	__ 4½U Dynetric Balancing Machine
__ 4L Saddle Type Turret Lathe	__ 6U Dynetric Balancing Machine
__ 5L Saddle Type Turret Lathe	__ Dynetric Micro-Balancer

Firm Name .....

Street Address .....

City ..... *State* .....

By ..... *Title* .....

American Quality Cold Rolled Strip-

Converts handbag frame plant into country's largest producer of 40 mm. shell charger clips

TYPICAL of the process conversion by which American civilian factories proved that they could outproduce any country in the world in making war munitions is this switch-over accomplished by the Frank J. Quigan Company, Inc., of Long Island.

In 1941 this company was the country's biggest maker of metal parts for ladies' handbags. Late that year they decided to produce badly needed 40 mm. shell charger clips for the Bofors anti-aircraft cannon.

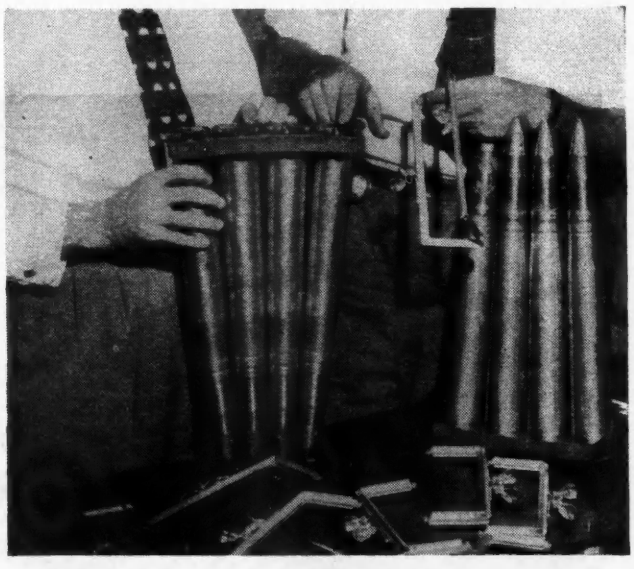
As made at that time, this clip contained special screw machine parts. But Quigan had no screw machines of the type needed. The clip required the use of batteries of milling machines. Quigan had several, but more were unavailable. The body was a zinc casting. Zinc was critical and Quigan possessed no casting facilities.

Over a single week-end, their engineers and toolroom turned out a handmade sample of an all-steel charger clip, *stamped from strip steel** that was not only stronger but 50% lighter. That could be turned out at least 20 times faster. That cost 27 cents instead of $1.85 each.

When War Department tests proved this clip the most durable in action, the most accurate in performance, the first contract for 2 million was awarded. Subsequently, shipments of the clip out of the Quigan plant reached a rate of more than a million a month, both for Army Mark II and Navy Mark IV Bofors ammunition.

★ ★ ★

* **Millions of pounds** of U·S·S American Cold Rolled Strip have been used in this clip. We believe it safe to say that the close tolerances of .001" required of the 13 stampings that make it up, and the high production speeds called for could only have been obtained by strip steel kept consistently uniform and whose physical and metallurgical properties have been rigidly maintained, in shipment after shipment.



HANDBAG FRAMES THAT BAGGED ZEROS. In surmounting the many difficulties encountered and in developing this 40 mm. cartridge clip and the high speed manufactured processes that make it possible to meet, *with stamped parts*, tolerance levels usually required for machined parts, Quigan Company has done an outstanding job that has won warm commendation from both War Department and Navy officials. The things they have learned in this important war application will inevitably be reflected in their postwar civilian products.

24 HOURS A DAY coils of U·S·S American Quality Cold Rolled Strip like these passed swiftly through presses ranging in capacity from 16- to 300-tons, to be converted into hundreds of thousands of 40 mm. charger clips every week. Unfailing uniformity in the gage, size and physical properties of this superior strip steel is a potent factor in keeping production flowing on schedule.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Export Company, New York

UNITED STATES STEEL

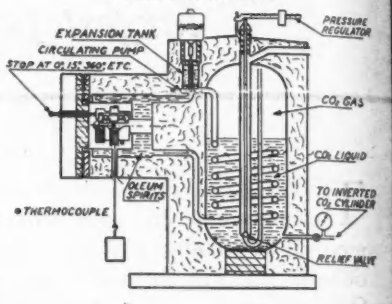
USS STEEL UNITED STATES STEEL

COLD ROLLED STRIP

Constant Torque Tester

The schematic diagram shows a constant torque device currently recommended by the joint ABEC-NLGI Committee on low temperature torque tests. Thermocouples are located in the center of the test bearing shaft, in the enclosed air space ⅛ in. from the outer race retainer, and in the cooling chamber itself. For refrigeration, the latent heat of vaporization of carbon dioxide is utilized. A suitable coolant, such as oleum spirits, is circulated by a small rotary pump through an annular jacket around the test bearings and also, by means of suitable tubing, through a chamber containing liquid carbon dioxide. The pressure in the chamber is regulated and the boiling point of the liquid CO_2 thereby adjusted until the bearing assembly reaches the desired temp. A weight-loaded "pop-off" or pressure-relief valve is provided for this purpose. So that the valve will not freeze and become inoperable, it is located at the lowest point in the chamber in order that it will be covered by liquid as long as any is present. Once the required pressure is reached and the weight loading of the valve fixed, the liquid CO_2 keeps boiling at a constant temp.

COOLING MECHANISM



Any small increase in temp produces an increase in pressure sufficient to open the pressure-relief valve. The original conditions of temp and pressure are promptly restored by the cooling effect exerted as more liquid boils off and gaseous CO_2 expands through the valve. Equilibrium conditions result from repeated opening and closing of the relief valve in this manner until finally a very small quantity of gas passes out at a steady rate. Inasmuch as a pressure change of 3.0 psi corresponds roughly to 1.0 F change in the boiling point of liquid CO_2, the device affords quite precise temp control.

Monthly Truck and Truck Tractor Production

LIGHT
Under 9,000 lb. G.V.W.

	Civilian	Military	Total
January	....	21,621	21,621
February	159	20,641	20,800
March	1,784	21,926	23,709
1st Quarter	1,943	64,187	66,130
April	4,746	18,352	23,098
4 Months	6,689	82,539	89,228

MEDIUM
9,000 to 16,000 lb. G.V.W.

	Civilian	Military	Total
January	11,183	3,527	14,710
February	10,534	3,378	13,912
March	12,829	3,994	16,823
1st Quarter	34,546	10,899	45,445
April	10,275	3,645	13,920
4 Months	44,821	14,544	59,365

HEAVY
16,000 lb. and Over, G.V.W.

	Civilian	Military	Total
January	3,836	26,898	30,734
February	3,339	26,162	29,501
March	3,726	30,474	34,200
1st Quarter	10,901	83,534	94,435
April	3,964	26,288	30,252
4 Months	14,865	109,822	124,687

TOTAL
ALL WEIGHTS

	Civilian	Military	Total
January	15,019	52,046	67,065
February	14,032	50,181	64,213
March	18,339	56,393	74,732
1st Quarter	47,390	158,620	206,010
April	18,985	48,285	67,270
4 Months	66,375	206,905	273,280

Automotive Division—War Production Board.

CLEAN CUTS AT HIGH SURFACE SPEEDS

SUNICUT...

Improves Turning, Boring, and Threading Operations On Brass

The right cutting oil for the right operation can make the difference between rejects or parts which meet the most exacting requirements. This was amply proved by a manufacturer of precision parts when he switched from a competitive oil to Sunicut No. 973 for turning, boring, and threading on the following operation:

Type of Machine: National Acme Gridley Automatic Screw Machine; 2⅝" capacity; Model R.B.; Six Spindles.
Material Machined: Commercial Rod Brass
Operation: ..... Machining Booster Body for Fuse
Speed: ..... 400 Surface-Feet per Minute
Feed: ..... .003"
Lubricant: ..... Sunicut No. 973

With the competitive oil, it was difficult to maintain accuracy of finished parts. Threads were of poor quality, due to chatter-marks. Rejects ran high.

When a Sun Oil Company Engineer was called in, he recommended a change to Sunicut No. 973. Production increased. Accuracy was held to closer tolerances. Chatter-marks were eliminated. Better threads were obtained. Rejects were greatly reduced.

This is just one case taken from the hundreds in Sun's product-performance files. For factual proof of what Sunicut, the clear, transparent, non-emulsifiable cutting oil can do for you, test it in your own plant. Sun Products and Sun Engineering Service are yours to use to improve production. Write . . .

SUN OIL COMPANY · ***Philadelphia 3, Pa.***
Sponsors of the Sunoco News Voice of the Air — Lowell Thomas

SUNOCO → **SUN INDUSTRIAL PRODUCTS**
OILS FOR AMERICAN INDUSTRY

Structural Model Testing

By O. W. Loudenslager
Ass't Mgr., Research & Development
Goodyear Aircraft Corp.

ENGINEERS at the Goodyear Aircraft Corp. have developed unique unusually precise stress model signs to check theories on the st analysis of the indeterminate rigid ship structure. The theoretical model test results were found to h excellent agreement.

Model girders may have any pr cal shape which gives them corre scaled elastic properties. This is f nate for it is usually impractica make a structural model membe sealed-down replica of the prototy

Many different materials have used by numerous investigators the construction of stress models metals are preferred for the m under consideration. Goodyear us hard-drawn or spring-tempered low brass and similar high-stre non-ferrous metals. These metals good corrosion resistance, low mod of elasticity, easy machinability good solderability. Model mem have been successfully made of worked materials which cannot stress-relieved without drastic re tion in strength. However, it is practice to avoid the "locked stresses caused by bending, stam or shearing the parts. They sh rather be cut on a milling machin with similar equipment.

Care must be exercised in as bling models to avoid excessive e tricity. Wood was chosen for jig this purpose because it is inexpen and has low heat conductivity. testing methods used may be div into two classifications: The *ind* in which influence lines are first d mined from which stresses are obtained; and the *direct* in w scaled-down loads are directly ap to the model. The design of a m for indirect testing is fundamen the same as for direct testing in both should correctly represent the ness of the prototype. The model m bers must be capable of being bent unbent if bending moments are t determined. If large deflections ar pected, tension members, such as c and tie rods, may be represente coil springs.

The accuracy with which ge prototype loads can be determine use of direct-model testing procedu probably greater than that obtai with a full-sized structure. This i cause it is often difficult to distin between general and local loads in scale tests; whereas, models of type described indicate general only. Model test results were fou be accurate within approximately per cent.

This article is an abstract of a p presented at a recent meeting o SAE Buffalo section.

MILLION-A-DAY PRODUCTION OF AMMUNITION LINKS *as painted by James Sessions at the SPRING DIVISION in Bellwood, Illinois. This Borg-Warner plant revolutionized the making of Garand Rifle Clips and initiated several mass-production processes for the manufacture of links for the 50 Caliber Machine Gun that plays a major role in America's air supremacy. In peace it is a leading maker of mechanical precision springs for automotive valves and clutches.*

When the last bullet is fired industry's *know-how* will be building a better peacetime world.

Then, as in war, Borg-Warner will again provide important advances. For Borg-Warner makes not only complete products, but also essential parts for products of other industries. For example, Borg-Warner parts today are serving on 9 out of 10 farms, in 9 out of 10 airplanes, in 9 out of 10 makes of automobiles.

Also Norge appliances make the homes of millions more efficient. And these are just a few of the fields in which Borg-Warner products serve Americans daily.

From the beginning, the engineering and large-scale manufacturing of all B-W companies have been guided by the principle: "Design it better, make it better." And this ideal always is working to bring you ever better products at ever lower costs.

Partners with the automotive industry from the start, Borg-Warner parts today are serving in 9 out of 10 makes of automobiles...

ENGINEERING B-W PRODUCTION

TRANSMISSIONS • TRANSFER GEARS
OVERDRIVES • SYNCHRONIZERS • CLUTCHES
CLUTCH SPRINGS
UNIVERSAL JOINTS AND DRIVE SHAFTS
FLUID COUPLINGS • CARBURETORS
RADIATORS • TAPERED WHEEL DISCS

Peacetime makers of essential operating parts for the automotive, aviation, marine and farm implement industries, and of Norge home appliances . . . these units which form the Borg-Warner Corporation are today devoted exclusively to the needs of war: BORG & BECK • BORG-WARNER INTERNATIONAL • BORG WARNER SERVICE PARTS • B-W SUPERCHARGERS, INC. • CALUMET STEEL • DETROIT GEAR • DETROIT VAPOR STOVE • INGERSOLL STEEL & DISC • LONG MANUFACTURING • MARBON • MARVEL-SCHEBLER CARBURETER • MECHANICS UNIVERSAL JOINT • MORSE CHAIN • NORGE • NORGE MACHINE PRODUCTS • PESCO PRODUCTS • ROCKFORD CLUTCH • SPRING DIVISION • WARNER AUTOMOTIVE PARTS • WARNER GEAR

Automotive Council to Dissolve October 1

The dissolution of the Automotive Council for War Production as of Oct. 1 was announced by its president, Alvan Macauley. The decision to disband this nationwide organization of automotive companies was as purely voluntary as had been the decision that motivated its creation almost four years ago, Mr. Macauley said.

Formed in the dark hours of the nation's grave peril immediately after the attack on Pearl Harbor in Dec., 1941, the Automotive Council embraced a total of 64 manufacturing companies. Its membership represented the pooled mass-productive know-how of all of the nation's manufacturers of motor vehicles, in addition to most of the manufacturers of automotive bodies, trailers, automotive parts and accessories, and the major producers of automotive tools and dies, jigs and fixtures, and special purpose machinery.

This combination of industrial talent, created for the sole purpose of implementing the nation's defense with the total productive power of the automotive industry, is estimated to have been responsible for about one-quarter of the national output of weapons and materiel.

Officially, the life of the Automotive Council for War Production will be terminated on Oct. 1. A formal ceremony to signalize the event will be held as soon as the members can find sufficient time in their crowded working schedules to permit them to assemble. Time and place will be announced later.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Sharp fluctuations in business activity following the Japanese surrender, with a general downward trend, are indicated by current reports. After declining to 112.5, the lowest in nearly five years, in the week ended Aug. 18, *The New York Times* index rose to 127.5 in the following week. The current figure compares with 142.3 a year ago.

Sales of department stores, as reported to the Federal Reserve Board for the week ended Aug. 25, were 6 per cent larger than in the corresponding period last year. This gain compares with a decline of 16 per cent in the preceding week, reflecting the holidays following the surrender of Japan. Sales during the four weeks ended Aug. 25 were 7 per cent above the comparable figure a year ago, and the similar gain for the year to that date is 12 per cent.

Electric power production in the same week was 6.8 per cent smaller than in the comparable period last year but was considerably larger than in the preceding week. With that exception, however, it was the smallest since the first week in July.

Railway freight loadings in the week ended Aug. 25 totaled 853,426 cars, which is 30.7 per cent above the figure for the preceding week but 5.7 per cent below that for the corresponding period last year.

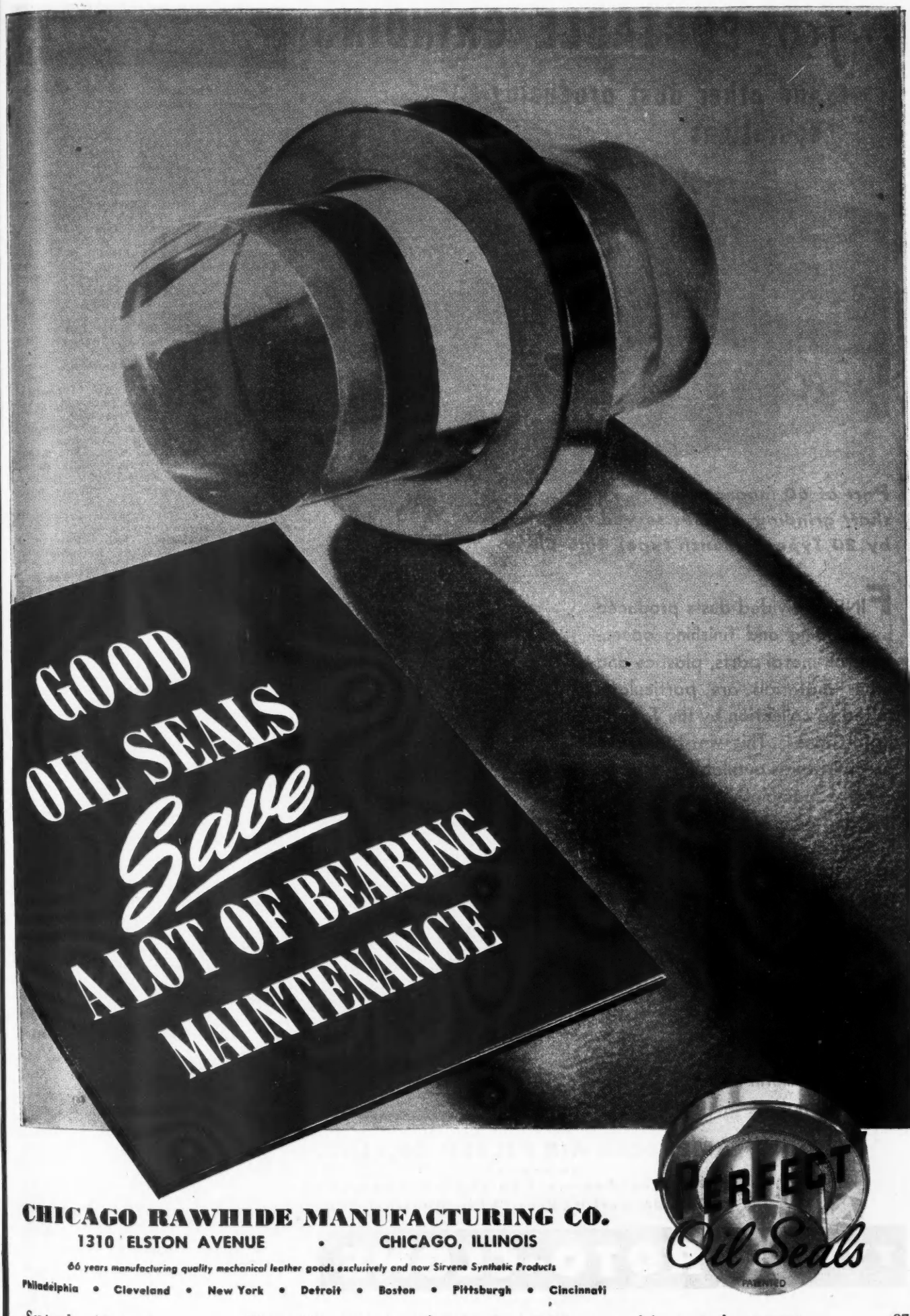
Crude oil production for the week ended Aug. 18 averaged 4,933,850 barrels daily, only 200 barrels below the daily average for the preceding week and 32,950 barrels above the output recommended for August by the Petroleum Administration for War.

Bituminous coal production for the same period is estimated at 6,920,000 net tons, as against 11,540,000 tons a week earlier and 11,934,000 tons a year ago. Total production so far this year has been 7.8 per cent below the comparable figure for 1944.

Engineering construction contracts awarded during the week ended Aug. 30, according to *Engineering News-Record*, totaled $35,300,000, as against $22,990,000 for the preceding week, shortened by holidays, and $60,282,000 for the corresponding period last year. Private construction exceeded the comparable 1944 figure by 163 per cent and for the sixth time this year was larger than public construction.

The *Journal of Commerce* weekly index of wholesale commodity prices as of Sept. 1 stands at 110.8 per cent of the 1927-29 average, as against 111.6 a week earlier and 108.2 a year ago.

Member bank reserves rose $78,000,000 during the week ended Aug. 29, mainly because of Government expenditures as reflected in a decline of $274,000,000 in Treasury deposits with the Federal Reserve banks, partly offset by an increase of $94,000,000 in the amount of money in circulation, a decrease of $79,000,000 in Reserve bank credit outstanding, and other changes.



CHICAGO RAWHIDE MANUFACTURING CO.

1310 ELSTON AVENUE • CHICAGO, ILLINOIS

66 years manufacturing quality mechanical leather goods exclusively and now Sirvene Synthetic Products

Philadelphia • Cleveland • New York • Detroit • Boston • Pittsburgh • Cincinnati

PERSONALS

Recent Appointments Among Automotive and Aviation Manufacturers:

General Motors Corp., Delco-Remy Div., **H. E. Nye,** Mgr. of Delco Battery operations, succeeding **B. A. Dollens,** now Gen. Mgr. Saginaw Malleable Iron Div.

Chrysler Corp., Dodge Div., **L. F. Van Nortwick,** Director of Truck Sales. Chrysler Airtemp Div., **Edward G. Lickteig,** Master Mechanic, and **W. A. Lavoie,** Plant Engineer, Dayton and Indianapolis plants.

Bethlehem Steel Co., **R. A. Lewis** retired as general manager, Bethlehem plant. **J. H. Stoll,** Engineer of Tests, and **T. G. Foulkes,** Asst. Engineer of Tests, Bethlehem plant.

The Dow Chemical Co., **Arthur Smith, Jr.,** Mgr., Cathodic Protection Sales Dept.

Herbert H. Davis Co., **A. E. Whitney,** Vice-Pres. and General Sales Mgr.

Bendix Helicopter, Inc., **Charles L. Morris,** Asst. to President.

Curtiss-Wright Corp., **Robert K. Brown,** Mgr., Washington office.

Wright Aeronautical Corp., **Richard S. Huested,** Administrative Assistant to **William D. Kennedy,** Vice-Pres. and Gen. Mgr.

The Glenn L. Martin Co., **Frederic S. Cross,** Chief Resident Legal Counsel.

Beech Aircraft Corp., **E. S. Safford,** head of newly organized export sales department; **W. Homer Kelly,** Public Relations Director and director of company advertising.

Rogers Diesel and Aircraft Corp., **Walter Parrish,** Chief Engineer.

Republic Aviation Corp., **Preston H. Mabry,** Asst. Sales Mgr., Personal Plane Div.

Pennsylvania Salt Mfg. Co., **George T. Collins,** Asst. Mgr. of Market Research.

Bendix - Westinghouse Automotive Air Brake Co., **Dexter S. Kimball, Jr.,** Factory Mgr.

Rustless Iron and Steel Corp., **Stanley P. Watkins,** Mgr. of Market Development Div.

Portable Products Corp., **C. H. Tagliabur** Div., **E. D. Wacker,** General Manager.

Cherry Rivet Co., **Carl P. Sorenson,** Consulting Standards Engineer.

Celanese Corp., election of **Edward W. Ward** as Vice-Pres., Celanese Plastics Corp.

Allis-Chalmers Mfg. Co., **Lee H. Hill,** resigned as Vice-Pres. Industrial Relations.

Brown Instrument Co., **Sigfried A. Olsen, Jr.,** Industrial Mgr. at Stockholm, Sweden.

Macmillan Petroleum Corp., **James A. Edwards,** Sales Mgr., Grease Dept.

K-D Lamp Co., **Harold B. Frye,** Commercial Engineer.

Jessop Steel Co., Stainless Steel Div., **W. L. O'Brien,** Mgr.

Continental Motors, Muskegon Div., **J. W. Kinnucan,** Vice-Pres. in charge of aircraft engineering; Muskegon and Detroit Divs., **Thomas J. Jackson,** Vice-Pres. in charge of quality.

Mack-International Motor Truck Corp., Mack White Plains (NY) Branch, **Captain Ralph L. Tompkins,** Mgr.

Aerosphere, Inc., **Charles E. Thorp,** Executive Editor and Publisher, succeeding **Glenn D. Angle,** resigned.

Casco Products Corp., **Norman P. Levine,** Asst. Purchasing Agent; **O. S. Solomonson,** Traffic Manager.

Aircooled Motors Corp., **Lewis E. Pierson,** resigned as President and Director. **Carl F. B. Roth,** elected President; **C. F. Carr,** Secretary-Treasurer, elected director to fill vacancy.

General Electric Co., **Harry A. Winne,** Vice-Pres. in charge of engineering policy for entire company.

Westinghouse Electric Corp., **A. C. Monteith,** Asst. Mgr. of Headquarters Engineering.

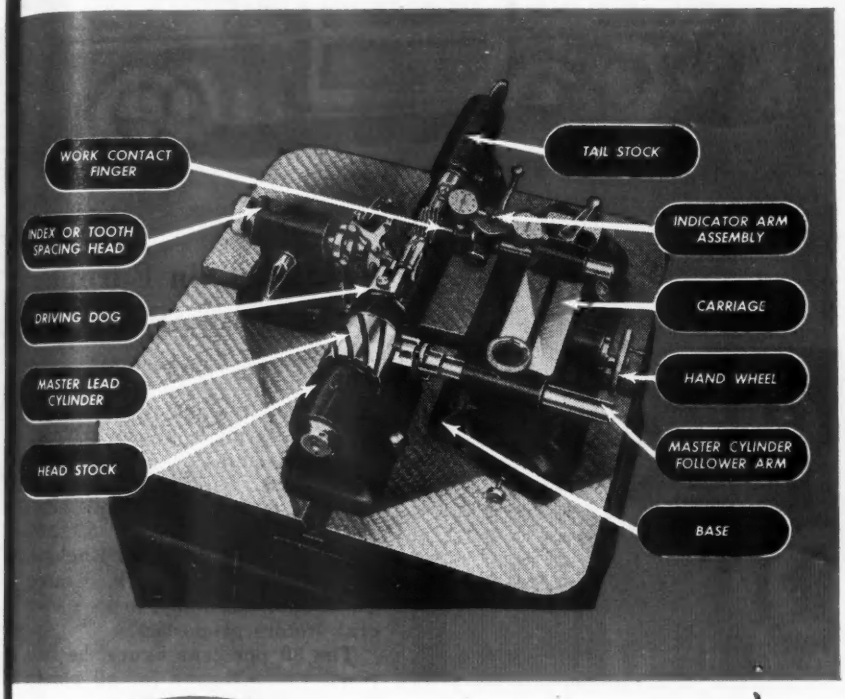
The B. F. Goodrich Co., B. F. Goodrich International Div., **H. E. Heilman,** Operations Mgr.

Nox-Rust Chemical Corp., **Dr. Eugene Lieber,** Technical Director of Manufacturing.

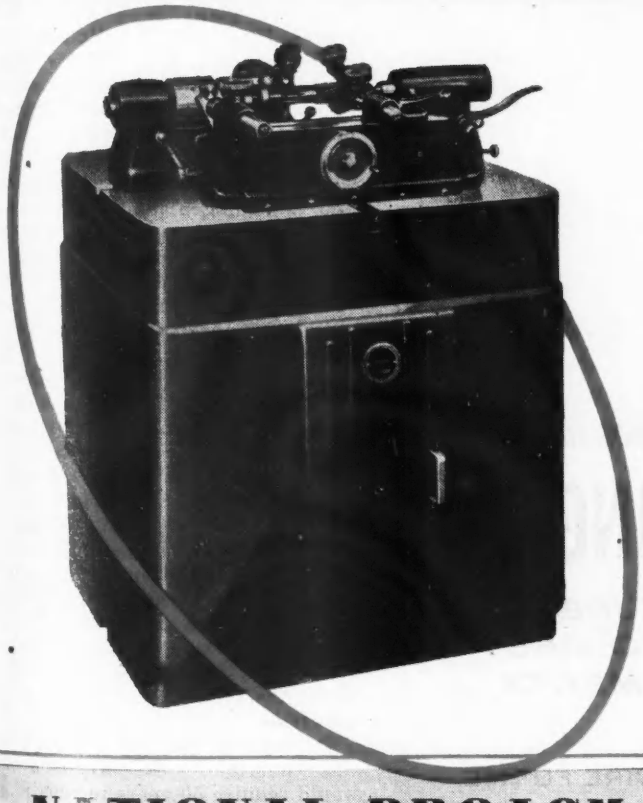
Pioneer Engineering and Mfg. Co., **Wilbur F. Campbell,** resigned as Asst. to the President.

Dockson Corp., **A. Carl Tiedemann,** elected President.

CHECK GEAR ERRORS



INDEX
HELIX ANGLE
LEAD
TOOTH SIZE
ECCENTRICITY
INTERFERENCE
WOBBLE



The Red Ring Universal Gear Checker is a simple, compact instrument for accurately checking dimensional errors in either spur or helical gears. With the application of special equipment, this machine will check leads accurately against a master lead gage, errors being registered on a "tenth" indicator. Its simplicity makes it possible to check gears quickly without sacrificing accuracy. Its ingenious design practically eliminates the human equation and therefore the need for skilled operators.

The Red Ring Universal Gear Checker is built in three sizes, the 12" size for gears from ¼" to 12-11/16" O.D., the 18" size for gears from 2" to 18⅞" O.D., and the 24" size for gears from 3" to 24⅞" O. D.

WRITE FOR DESCRIPTIVE BULLETIN

NATIONAL BROACH AND MACHINE CO.

RED RING PRODUCTS

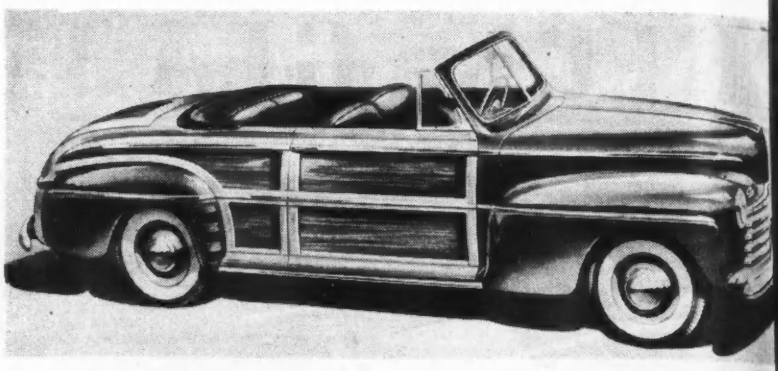
3600 ST. JEAN • DETROIT 13, MICH.

Specialists on SPUR AND HELICAL INVOLUTE GEAR PRACTICE

Originators of ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

Ford Sportsman's Convertible

This car, with the appearance of a station wagon and the convertible top and close-coupled seating of a convertible coupe, will be in limited production soon after the public announcement of the 1946 Ford models. The wooden panels of the new body are applied over a steel frame. The power-operated top used on the convertible club coupe and the standard type window raisers and other fittings are utilized. Inside, the car will be finished with leather upholstery.



GM Plants in Europe Damaged by War

As a result of damage during war, only about 30 per cent of Gen Motors plant capacity in Europe is in operating condition. That is report brought back by Lieut.-G William S. Knudsen, member of board of GM and former president, returned recently from a 12,000-m inspection tour through England, N way, Sweden, Denmark, France, gium, and Germany to look over G eral Motors properties.

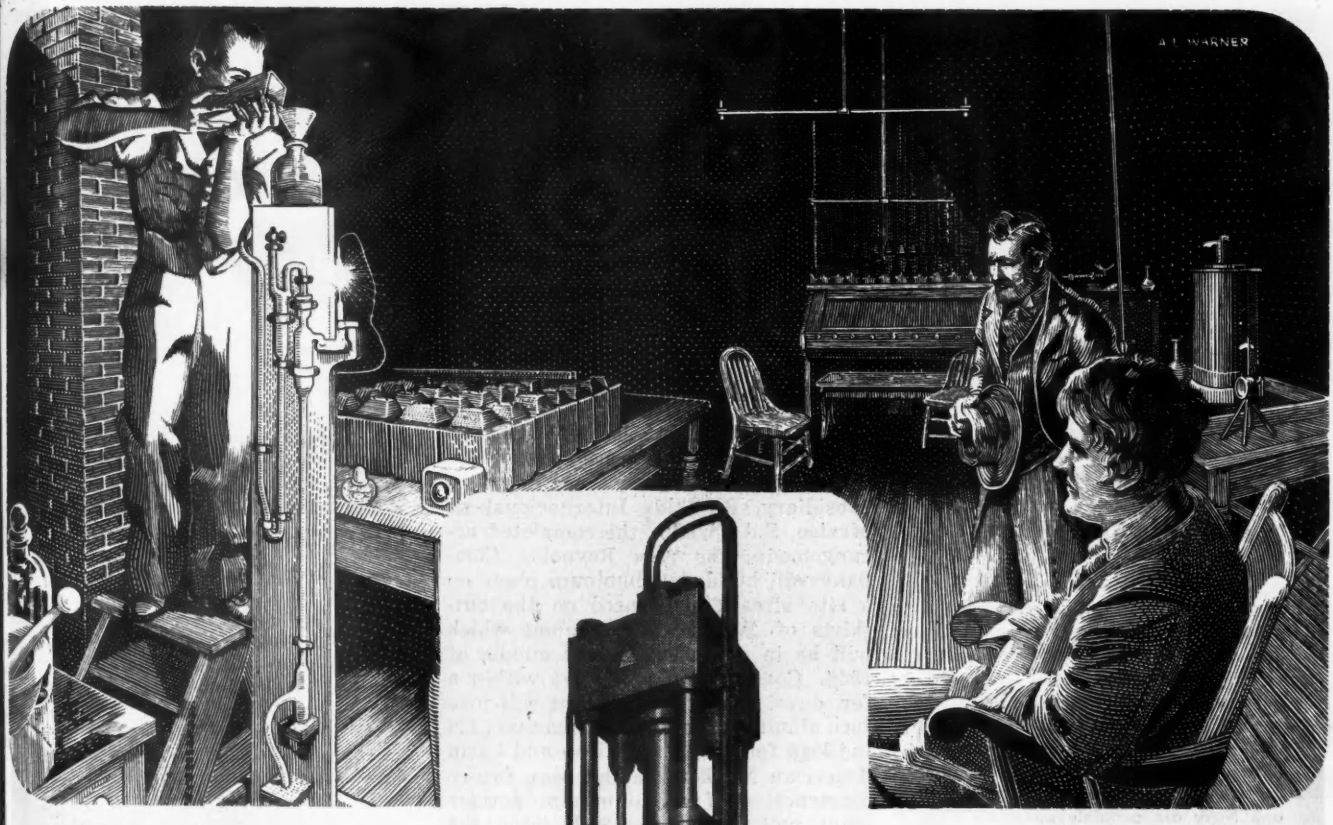
The 30 per cent figure, he said, r resents an average for all plants. Vauxhall plant in England, the A Spark Plug and the Frigidaire un at Paris, and the assembly plants Stockholm and Copenhagen were damaged, and with the exception of latter two still are operating. Vauxh is manufacturing 2½-ton trucks the English government. The Stockho and Copenhagen plants have not op ated for five years, but will resu operations as soon as parts and sub semblies can be produced and shipp from this country, probably in cember. Capacity is about 20,000 c a year each.

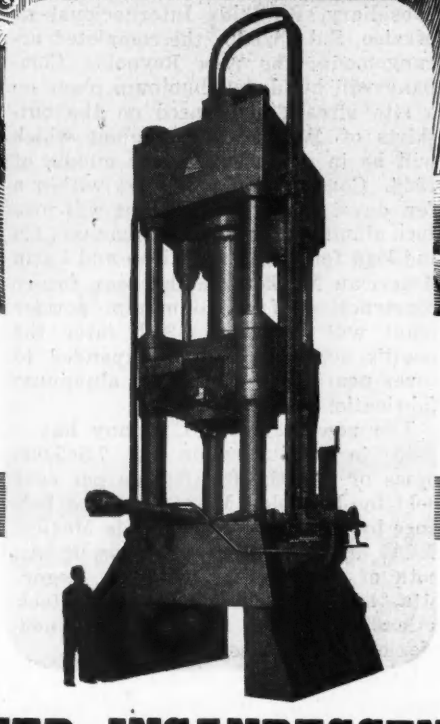
Condition of other G.M. plants w reported by Knudsen as follows: A werp, large assembly plant 99 per c destroyed; Berlin, truck plant destro ed; Russellsheim (near Frankfor Opel plant about 50 per cent go Brandenberg, plant badly damaged a stripped. G.M. has no plans for resu ing operations in Germany, he said, a must await settling of reparations b fore knowing whether it will be co pensated for war damage to its plan He did not reveal what would be do with damaged installations in oth countries.

Damage to Berlin, Knudsen state was "horrible." He predicted that would require 50 years to repair the d vastation. De-industrialization of Ge many would not work, he stated, sin the country always has been the sour of supply for steel and industrial equi ment for central Europe. Internationa ization of industry there might wor he added, but the problem will requir intensive study before it is worked ou

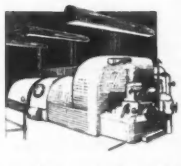
The trend toward the left is marke

(*Turn to page 92, please*)





WHO INVENTED INCANDESCENT LAMPS?



You'd muff the $64 question if you said that Thomas Edison invented incandescent electric lights. Long before his time, such lamps were dispelling darkness in various parts of the world. Why then do most of us link the idea of electric lighting with Edison's name? Because he combined existing methods, new techniques and his own ideas to give incandescent lighting far greater adaptability, reduce its cost, make it practical.

What Edison did in lighting, Clearing has done in the field of forming metal with presses. Many press operations taken for granted nowadays could not be performed before Clearing brought the designing and building of such machines up to date. Today, "Clearing" is synonymous with presses that produce more per hour, that work to closer tolerances on work of ever-increasing size.

It costs nothing to learn how Clearing can help you lower production costs, increase profits with presses to do the "can't-be-done" kind of jobs. Write today for full details.

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in all countries he visited, Knudsen stated. The Renault plant at Paris has been nationalized and the government exercises control over all industrial offices.

A tremendous export exists for American automotive products in Europe if the proper means can be found to finance their purchase, Knudsen stated. The industry can dispose of all it can build over and beyond domestic needs, he said.

Reynolds Metal Co. to Open Mexican Subsidiary

Reynolds Metal Co. has arranged the financial set-up and selected the personnel for the company's new Mexican subsidiary, Reynolds Internacional de Mexico, S.A. Under the completed arrangements the new Reynolds Company will build an aluminum plant on a site already purchased on the outskirts of Mexico City, a plant which will be in operation by the middle of 1946. Construction will start within a few days. Initially, the plant will produce aluminum sheet and aluminum, tin and lead foil for the Mexican and Latin American Market. In the near future construction of an aluminum powder plant will be begun. Still later the plant's activities will be expanded to cover nearly every phase of aluminum fabrication.

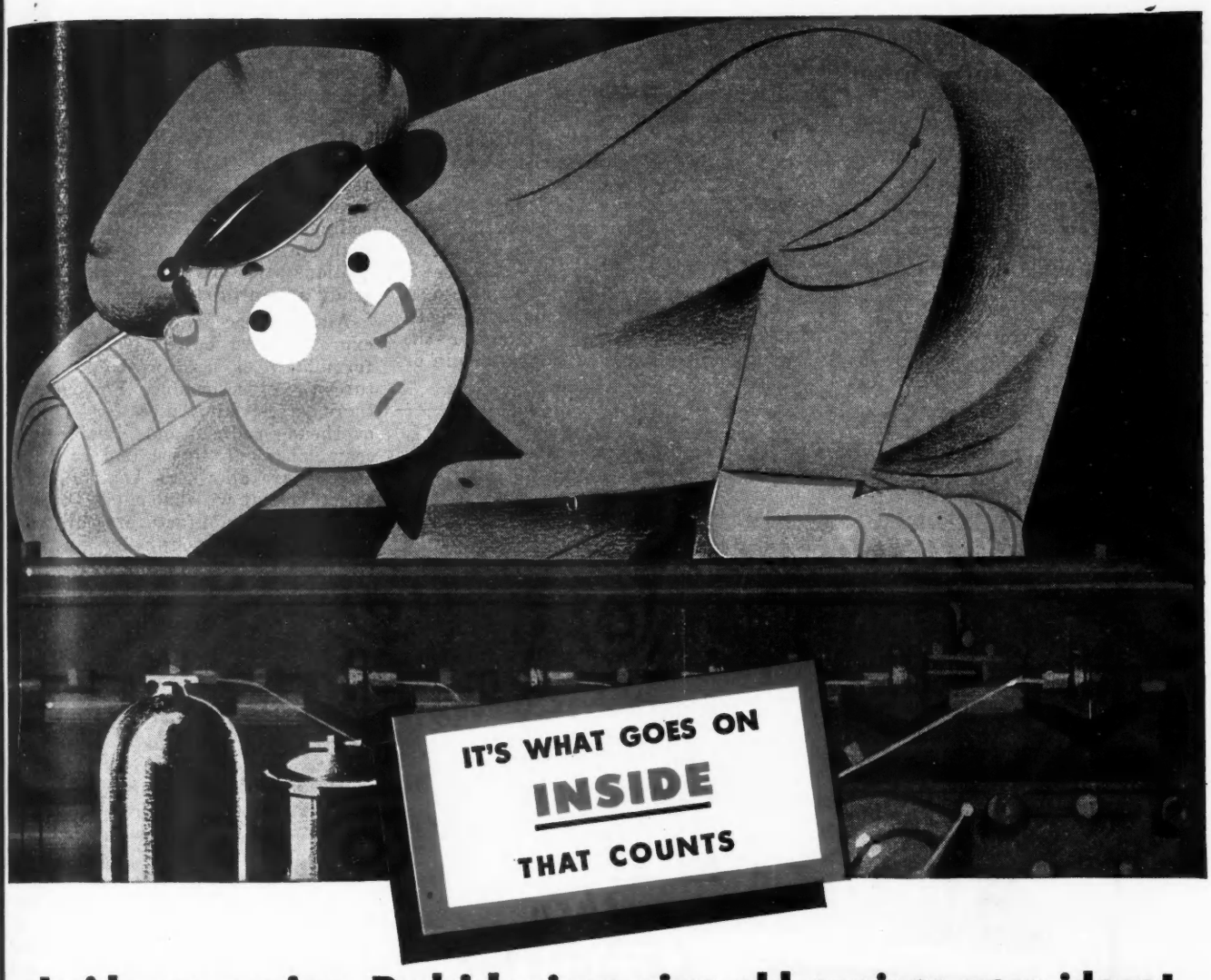
The new Reynolds Company has a paid in capitalization of 7,545,000 pesos or $1,509,000, fifty-one per cent held by Reynolds Metals and the balance by the Banco Nacional de Mexico, S. A. and Inversiones Latinas, S. A., both of Mexico City. Luis G. Legoretta, head of the later concern, took a leading part in setting up the new Mexican enterprise.

Of the company's nine directors, five are officials of Reynolds Metals and four are Mexican citizens. The nine, with their official titles are: R. S. Reynolds, chairman; J. Louis Reynolds, president; Walter L. Rice, vice president; R. S. Reynolds, Jr., vice president and treasurer; Edwin Taranger, vice president and general manager; Atanasio G. Saravia, vice chairman, Angel Rivera, Felix Aramburu Zavala and Emilio Thalman. The latter four are the Mexican directors.

C. Davis Blackwelder, Reynolds vice president, selected the site, designed the new plant and arranged for its equipment.

Chandler-Evans Will Move Operations to West Hartford

All of the operations of the Chandler-Evans Corp. will be moved to the plant of the parent company, Niles-Bement-Pond, at West Hartford, Conn. This move will be made as rapidly as possible, and it is expected that it will be completed by the end of this year. There will be no change in the separate identity of the products or the company.



Inside an engine, Pedrick rings give old engines new ideas!

YOU CAN GET better service out of engines, and increase the time between necessary overhauls by using Pedrick rings. Because Pedrick rings are extra flat, they are less likely to stick. Because they are Silcoated, they "wear-in" better. Because they have exceptionally uniform radial pressure, they seal the cylinders more effectively.

The Pedrick Heat-Shaping process is responsible, in many ways, for the outstanding performance of Pedrick rings. This process is exclusive with Pedrick. It removes the stresses and strains set-up in the metal when the rings are machined, eliminating the tendency of the average ring to warp in service. It sets exactly the right amount of tension in the ring, evenly distributed around its entire circumference.

Pedrick rings have those little extras in quality that help your engines perform better, longer. Whether you use them as original equipment, or for servicing through your dealers, you can count on the kind of performance that builds satisfied customers. WILKENING MANUFACTURING CO., Philadelphia 42, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada), Ltd., Toronto.

Pedrick

precisioneered PISTON RINGS

U. S. WAR BONDS—YOUR MONEY IN THE SAFEST BANK IN THE WORLD!

Labor Trouble Greatest Reconversion Impediment

(*Continued from page* 42)

If necessary, substitutes can be used. One development is a lead-antimony solder, but tests so far indicate that it requires about three times as long as tin solder to get a satisfactory bond, a fact which would either slow up production or require considerably more equipment and space. The same applies to anodizing pistons. Where they formerly were tin plated in one small tank, the anodyzing processes would require a much greater outlay of equipment.

While prices on 1946 models have not yet been announced by the companies, all are said to have received from OPA a formula for figuring their own ceilings. Briefly it provides for ceiling price adjustments based on costs in the last period of normal production—October 1 to October 15, 1941, except for Packard, whose date is February 2, 1942—to which are added increases in basic wage rates and material costs, plus a profit margin of either the manufacturer's own 1936-39 margin or one-half the industry average for that period, whichever is higher. The formula is complicated and offers many difficulties. One company estimates it will take at least three weeks to compute its prices and then they must be approved by OPA before becoming effective. It is expected, however, that most manufacturers will have their ceilings approved in time to coincide with start of production. Notable exceptions are Ford and Hudson, who already are in production.

Although no manufacturer has yet expressed an opinion of the price formula, it is certain that some features are objectionable. For one thing, there is no allowance for increased overhead, selling and administrative costs, since only direct factory cost increases are allowed. Another complication is that with labor clamoring for pay raises, manufacturers must compute costs at present rates, not knowing whether a subsequent pay boost would be followed by a corresponding increase in ceilings. In a way, however, this also has the effect of putting the onus of pay increases on the government, since a provision of the formula prohibits computing, as increases in basic wage rates, any increases made voluntarily or through collective bargaining after the President's recent wage unfreezing order. The next effect is to throw any future pay raise disputes into the hands of WLB or some other designated agency, since under the terms of the formula increased rates arrived at through company-union negotiation are not considered valid as a base for increasing ceiling prices. In other words, only wage increases forced on the manufacturer through governmental action are allowable, and as a result, as long as price control remains, manufacturers are not likely to grant pay increases voluntarily because they cannot legally increase ceilings.

Plant clearance is going along fairly well and has caused no appreciable delay to date. However, there is some cause for concern in the rapidly mounting flood of demands being made on RFC to get machinery out of the way, and there is a possibility that a log jam may yet develop. If such is the case, however, it should be of short duration.

U. S. Plywood to Distribute Decorative Micarta

Westinghouse Electric Corp. and United States Plywood Corp. have concluded an agreement whereby the latter becomes exclusive distributor for "Decorative Micarta," a laminated plastic sheet made by Westinghouse.

United States Plywood warehouses throughout the country will provide distribution for the plastic sheets and special fabricated items. The company also will have complete responsibility for sales, advertising, promotion and service of decorative Micarta.

SAE Names New Board

(*Continued from page* 44)

nical committee activities which wi render engineering advisory service t industry and government.

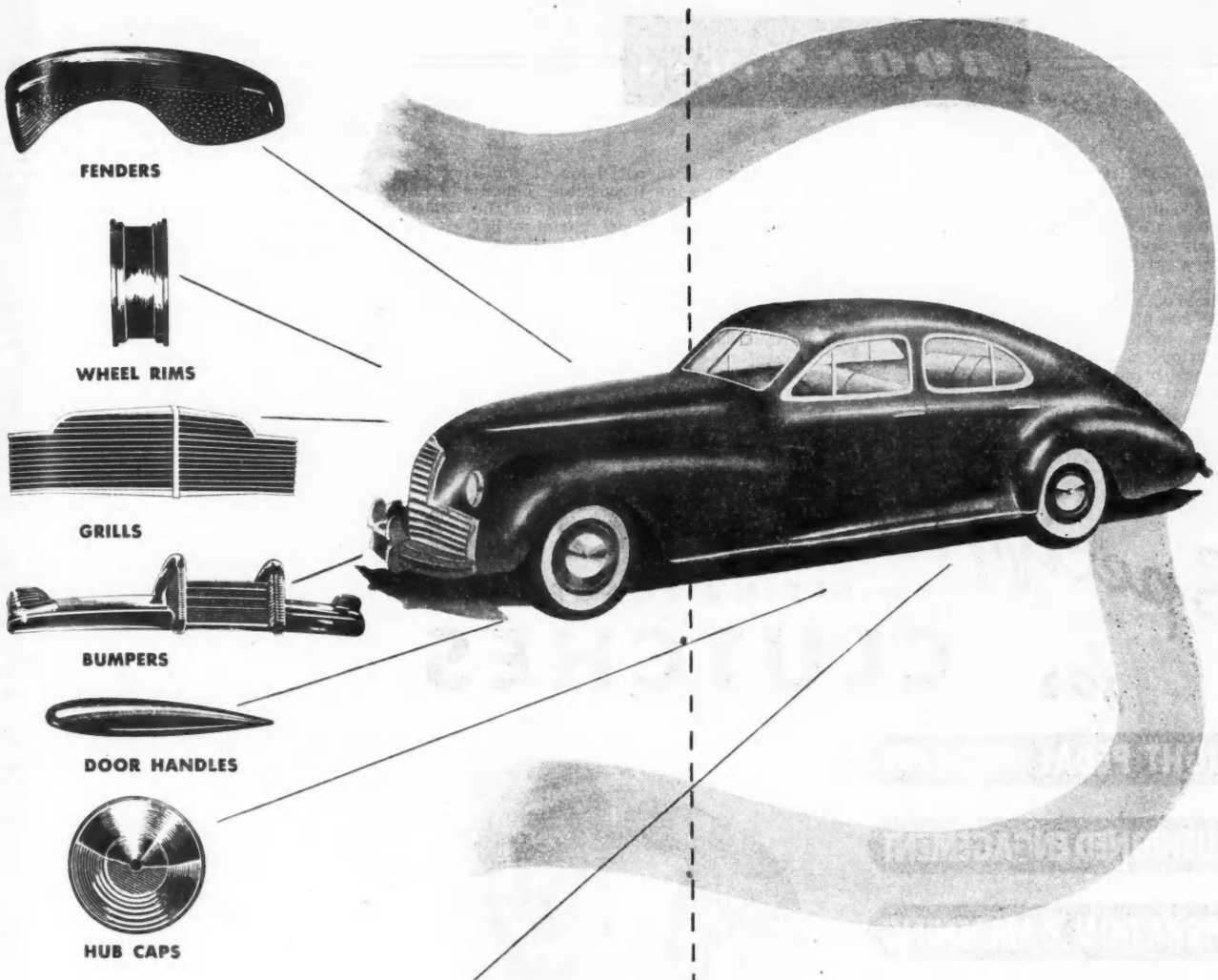
Members of the new Board, in a dition to Chairman Buckendale, are B. B. Bachman, engineering vice-pres dent, The Autocar Co., Ardmore, Pa. D. P. Barnard, associate research d rector, Standard Oil Co. (Indiana Whiting, Ind.; Rex B. Beisel, gener manager, Chance Vought Aircra Div., United Aircraft Corp., Stratfor Conn.; A. T. Colwall, vice-presiden Thompson Products, Inc., Clevelan Ohio; and Roy E. Cole, engineerin vice-president, The Studebaker Corp South Bend, Ind.

Also, R. M. Hazen, chief enginee Allison Div., General Motors Corp., I dianapolis, Ind.; J. H. Hunt, directo New Devices Section, General Moto Corp., Detroit; R. D. Kelly, superi tendent of development, United A Lines, Inc., Chicago, Ill.; G. W. Laur automotive transportation manage The Atlantic Refining Co., Philade phia, Pa.; and William Littlewood, e gineering vice-president American Ai lines, Inc., Jackson Heights, L. I N. Y.

Also, Erle Martin, engineering ma ager, Hamilton Standard Propelle Div., United Aircraft Corp., East Har ford, Conn.; R. H. McCarroll, executi engineer, Ford Motor Co., Dearbor Mich.; Arthur Nutt, director of ai craft engineering, Packard Motor C Co., Toledo, Ohio, and Detroit; C. Paton, director of automotive enginee ing, Packard Motor Car Co., Toled and L. S. Pfost, chief engineer, Tra tor Div., The Massey-Harris Co., R cine, Wis.

Also, Delmar G. Roos, engineerin vice-president, Willys-Overland Motor Inc., Toledo; C. G. A. Rosen, researc director, Caterpillar Tractor C Peoria, Ill.; A. W. Scarratt, enginee ing vice-president, International Ha vester Co., Chicago; Mac Short, vic president, Lockheed Aircraft Cor Burbank, Calif.; T. C. Smith, aut motive engineer, American Telepho & Telegraph Co., New York; Ralph Teetor, engineering vice-president, T Perfect Circle Co., Hagerstown, Ind R. W. Young, chief engineer, Wrig Aeronautical Corp., Paterson, N. J and J. C. Zedre, chairman of the E gineering Board, Chrysler Corp., D troit.

Six members of the new Board a past presidents of SAE, Messrs. Bac man, Colwell, Hunt, Nutt, Roos, an Teetor. Mr. Young currently is SA Vice-President for Aircraft Pow plant Engineering, and Mr. Littlewoo is SAE Vice-President for Air Tran port Engineering. Mr. Buckendale a member of SAE Council, and M Bachman is SAE treasurer.



Parts For Your Postwar Automobile May Be Formed with Jessop cast-to-shape Tool Steels

NOW that certain types of civilian equipment have been authorized for manufacture, the experience of armament producers in using Jessop Cast-to-Shape Tool Steels will be an important factor in reconversion plans. Just as Jessop Cast-to-Shape Tool Steels have made possible increased economies in shaping and forming metals for war production, they will offer equal performance in the fabrication of such equipment as Instrument panels, Hub caps, Window panels, Fenders Bumpers, Bumper guards, Grills, Wheel rims, Wheels, Ornaments, Hardware, Trim, Rain drain molding, and many parts and accessories.

Dies made from Jessop Cast-to-Shape Tool Steels afford appreciable savings in material costs and production time. They are cast to the shape in which the die will be used and require a minimum of machine finishing. Analyses available include air-hardening, oil hardening, flame hardening and heat resisting as well as special analyses to meet individual requirements. This economical and time-saving method of making dies is worthy of your consideration. Write for the new Jessop Cast-to-Shape Tool Steel Booklet.

JESSOP STEEL Company

Head Office and Works
WASHINGTON, PA.

Established 1901

BOOKS . . . .

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE, eighth edition, published by *The Lincoln Electric Co.*, Cleveland, Ohio., has been entirely revised to include the latest data on new arc welding methods and equipment.

The book, which includes details of the most recent welding methods and techniques, incorporates a wealth of new information that obsoletes much of the previous literature on welding.

Special effort has been made by the authors to provide complete information to help those in all fields of industry obtain the greatest possible benefits from the process of arc welding in the design and construction of various parts and products and in the use of the process as a maintenance tool.

This "Bible of the Arc Welding Industry" carries many new illustrations, covering welding applications developed in various phases of war production which heretofore have not been published due to restriction.

In addition to standard data on welding symbols, speeds and costs, characteristics of metals, pre-heating, stress relieving, approach to welded design and other pertinent information, the newly revised Handbook includes sixteen new subjects such as. new cost tables; new welding techniques; mathematical calculations for new weld-designed structures; latest steel specifications on S.A.E. and A.I.S.I., including National Emergency Steels, etc.; underwater cutting; shop ventilation; maintenance of welding equipment; methods of testing; filler metal specifications for arc welding electrodes.

The principal sections of the new "Procedure Handbook," eighth edition, cover the following subjects: Welding methods and equipment; Technique of welding; Procedures, speeds and costs; Weld metal and methods of testing; Weldability of metals; Welded steel construction—machine design; Designing of arc-welded structures; Typical applications of arc welding in manufacturing, construction and maintenance.

The price of this eighth edition is $1.50, postpaid, in the United States—elsewhere $2.00 per copy.

HIGH-PRESSURE DIE CASTING, A DESIGN GUIDE FOR ENGINEERS, published by *H. L. Harvill Manufacturing Co.*, Los Angeles, Cal., Price, $5.00.

The authors have concerned themselves with emphasizing the design aspects of die casting rather than presenting only the analysis of the end use of parts produced by this method. In the first twenty pages, the process of die casting and metals used is clarified for the sake of readers who may have no previous knowledge of or experience with die casting techniques. The balance of the text emphasizes the types of die casting dies and their varying degrees of complexity, the relationship of casting design to die design and, with this material as a foundation, the text then goes into a comprehensive discussion of the important elements of correct design of parts to be produced by the die casting method. Considerations such as draft or taper on all surfaces of the casting, the effect of sectional variation on metal shrinkage and upon the finished product, the use and correct design of hubs and bosses, the practicability of die cast threads and the use of cast-in inserts are all covered in the text and each subject is fully illustrated. A comprehensive and usable chart of tolerances is given.

An entire chapter is devoted to a discussion of pressure mold or premium quality die castings with particular reference to recent specifications wherein mechanical properties far higher than any previously adopted by the industry are provided. The book deals with some of the simplified methods of machining die castings, as well as discussing the finishing and inspecting of die cast parts. Twenty-five typical die castings are discussed covering a wide variety of metals used and types of castings produced with an explanation of the use of the part and those elements of its design which made it a successful die casting. A complete glossary of die cast-terminology is also included. The book is indexed and cloth-bound.

INDUSTRIAL MANAGEMENT, by *Knowles and Thomson. Pub. The Macmillan Co.*, 791 *pp.* This book represents a fresh approach to the subject and is designed for students of industrial management whether they are engaged in business or learning the fundamentals. While the subject matter is treated comprehensively it is confined to topics of immediate concern to business managers. The text is arranged in six major parts—introduction, management of physical property, organization of the physical plant, management of manpower, production control, and cost control, the latter three comprising unique treatment of the subject not previously covered in the literature. Recognizing the interrelation of the elements of industrial management, the authors have unit-

(*Turn to page* 100, *please*)

AMERICAN BOSCH SPECIFIES SIRVENE

for High Altitude Magnetos

• When the pressure is low, at high altitudes, American Bosch magnetos deliver faultless performance. . . . And Sirvene gaskets and cable boots are on the job to help maintain that dependable service. Take the Sirvene gasket, for instance. In order to avoid the effects of reduced air density the interior of the magneto is pressurized. A *positive* seal is necessary around the entire distributor block and Sirvene engineers worked with American Bosch to perfect a special Sirvene formula and gasket design. A compound was developed which was soft, yet which had a good compression set, so that it gave the required positive sealing with a minimum of pressure. Another special Sirvene compound was engineered for the cable boots. In this instance, besides sealing against moisture, air and fluids, the boot serves as a solid insulation material between the cable piercing screw in the distributor and any external parts. As with all Sirvene products, extreme care is exercised in making these boots and gaskets. No flaw, however minute, is permitted, and all production procedures are executed under laboratory-type methods. All this is worth remembering when *you* have a problem concerning pliable parts which must operate in exceptional service conditions. You are invited to call upon Sirvene chemical engineers, whose backlog of experience and research is unsurpassed. They will be glad to help you.

SIRVENE

THE *SCIENTIFIC* COMPOUNDED ELASTOMER

A Product of the Synthetic Rubber Division

CHICAGO RAWHIDE MANUFACTURING CO.

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Pittsburgh · San Francisco · Cincinnati · Portland · Syracuse · Peoria

ized each topic so that the related aspects of any one will be found completely organized in each major section. The text is profusely illustrated and is supplemented with problems which require solution.

PRODUCTION LINE TECHNIQUE, *by Richard Muther. Pub. McGraw-Hill Book Co. 320pp.* Stemming from a project for the preparation of educational material on production line methods for use at the Massachusetts Institute of Technology, the material for this text was based upon a survey of modern manufacturing plants and represents the contributions of some of the most important producers in the automotive industry and in other fields. It explains the fundamentals of modern production lines, compares mass-production with job-lot production methods, and describes their nature, advantages and limitations. Topically the text covers the following broad principles: line production, methods and equipment, movement of material, plant layout, balance of operations, materials control, production control, modifications of line production. Of interest both to students and factory management, this book should mark an important contribution to the literature on modern manufacturing methods.

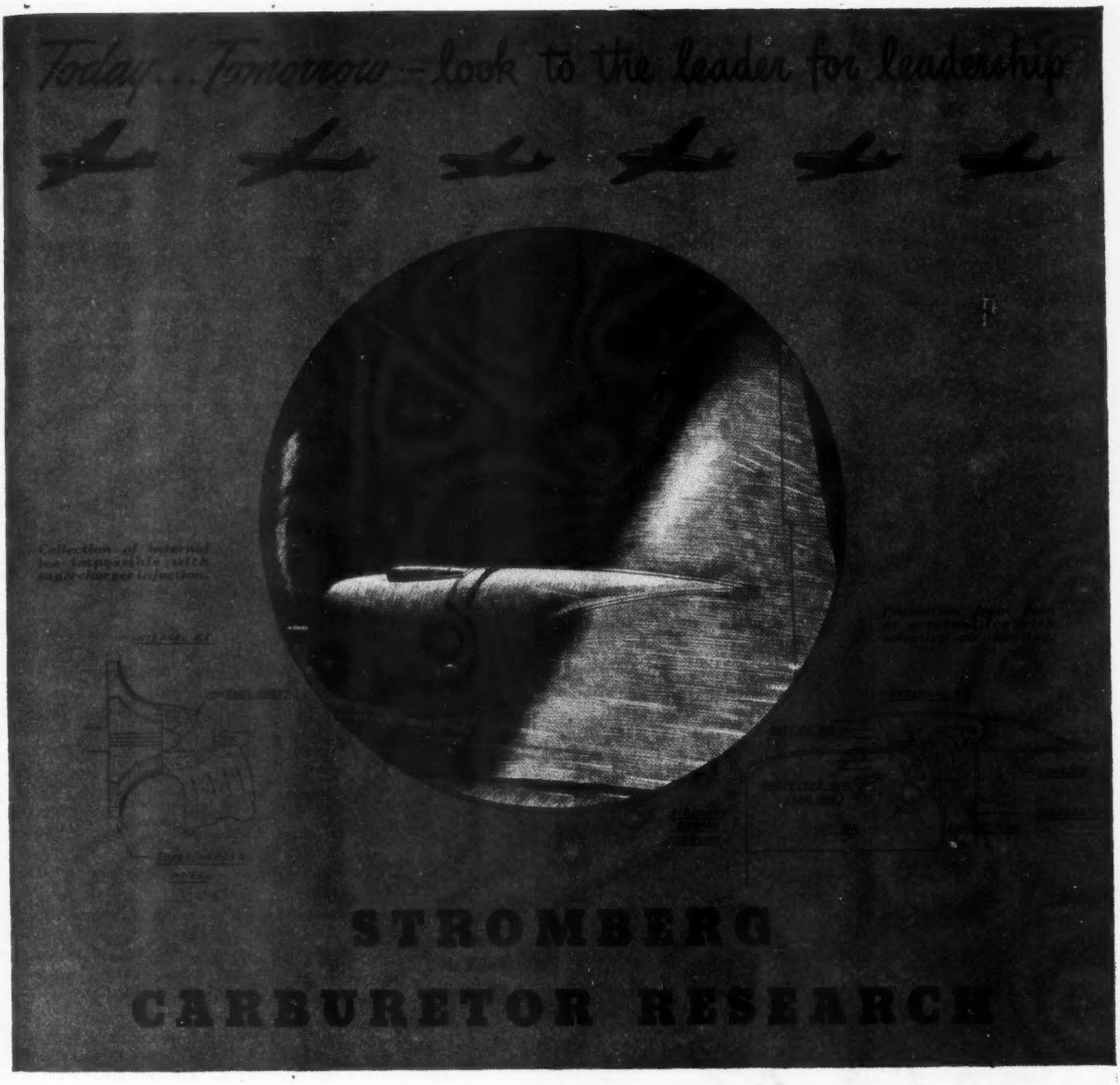
MOTOR TRUCK FACTS, biennial booklet of the Automobile Manufacturers Association, reveals through production statistics and quotations from high military and government officials the impact of the automotive industry's efforts on both battlefie'd operations and supporting activities on the home front.

It points out that the industry currently is building 226 distinctly different types of military vehicles. The truck manufacturers of the United States are now turning out military vehicles and spare parts at the rae of $2.5 billion a year, or 2.5 times the total value of all trucks and parts made in the peak peacetime production year, 1941. Of these purely military vehicles, 38 per cent have been shipped to Allied nations under lend-lease or direct purchase. More than 2,240,000 motor trucks have been built for the Army and the Navy since the beginning of the war, representing 877,000 light trucks under 9000 lb gross vehicle weight, 578,000 medium trucks from 9000 to 16,000 lb, and 785,000 heavies of more than 16,000 lb gross weight.

Indicating the important performance of motorized highway carriers on the domestic front, the booklet states that 4,744,000 trucks and 216,000 trailers were operating under certificates of war necessity on June 30 of last year, a total only slightly below the all-time peak in spite of tire rationing, greatly curtailed production of trucks for commercial use, and other wartime restrictions.

A significant section of *Motor Truck Facts* is the one dealing with the restrictive effects of conflicting state laws relative to motor vehicle sizes and weights. It states that lack of agreement among the states is tantamount to the erection of barriers around the borders of 15 of the 48 states. Since 11 of these states straddle the nation from the Canadian border to the Gulf of Mexico, east-west movement of materials by highway is impeded by almost as many barriers as is the flow of trade in Central Europe. The booklet contains a summary of recommendations for basic standards for trucks and highways which the National Interregional Highway Committee prepared for the Federal Government as a means of ending the interstate conflict.

In addition to the above information, the booklet presents up-to-date factual data on the truck industry, including production figures, factory sales, fleet data, and other statistical information of value to the trucking industry.



. . . showed the way to overcome ice hazards in aircraft carburetion

With the introduction of the Stromberg* Injection principle and the Stromberg Air Scoop it is now possible to eliminate the hazards of both internal and external icing of the carburetion system.

In the case of internal icing the Stromberg Injection principle permits locating the fuel spray in a warm part of the intake system, preferably at the engine supercharger entrance where ice will not accumulate.

The problem of external icing is met by the Stromberg Air Scoop principle, which for the first time offers the selection of protected rain-free air and a gradual selection of temperature rise.

These solutions to a dangerous threat to aircraft safety are typical of the problems occupying Stromberg's research engineers in their never ending quest for higher carburetor efficiency. Stromberg is constantly exploring new and exciting possibilities which promise remarkable advantages for our military aircraft today and for the commercial and personal planes of tomorrow.

Consult Stromberg on your carburetion problems.

Listen to "MEN OF VISION" *every week over CBS.*

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PRODUCT OF Bendix AVIATION CORPORATION

Bendix PRODUCTS DIVISION

Bendix Aviation Corporation, South Bend 20, Indiana

The Current Situation in the Aircraft Industry

(*Continued from page* 17)

the basis of a percentage of sales. Some contracts have already been signed for such leases.

In general the industry estimates that about two-thirds of its present facilities will be surplus by the end of the year and that present estimates of sales will require only about one-third of available facilities.

Hardest hit will be the subcontractors, which have carried such a heavy burden of the production effort. Whereas nearly 75 per cent of aircraft production (parts, subassemblies) during the war was carried on by outside production, the industry estimates that this will shrink to one-third of future production, roughly the prewar average.

The aircraft industry outlook depends much upon the final postwar aircraft procurement program approved by Congress. The Armed Forces, together with the industry, are extremely desirous that the technological gains made during the war be exploited in the future to the fullest extent possible. This means that the highly skilled research and development teams, that have been so laboriously gathered and trained during the war, be preserved at all costs.

The many research bills now before the Congress are only a partial answer to the problem for they provide basic research only as represented by the work of the National Advisory Committee for Aeronautics. Applied industrial research cannot be omitted from the national research effort and particularly is this true in the aircraft industry if America is to pursue her announced purpose of remaining the world's most powerful nation in the air. This latter is obligated by Article 45 of the United Nations Charter which pledges "national air force contingents for combined international enforcement action." The future size and importance of the aircraft manufacturing industry, then, is squarely up to the Congress in providing for military aircraft procurement.

The best available estimate on the size of the postwar aircraft manufacturing industry is provided by William A. M. Burden, Assistant Secretary of Commerce, who predicts total sales of the postwar industry of $1,270,000,000 made up of $1,000,000,000 in military aircraft, $170,000,000 in airline transport planes and $100,000,000 in personal aircraft. T. P. Wright, Civil Aeronautics Administrator, predicts a total employment of 335,000 in the postwar industry made up of 100,000 in personal aircraft, 25,000 in transport aircraft and 210,000 in military aircraft construction.

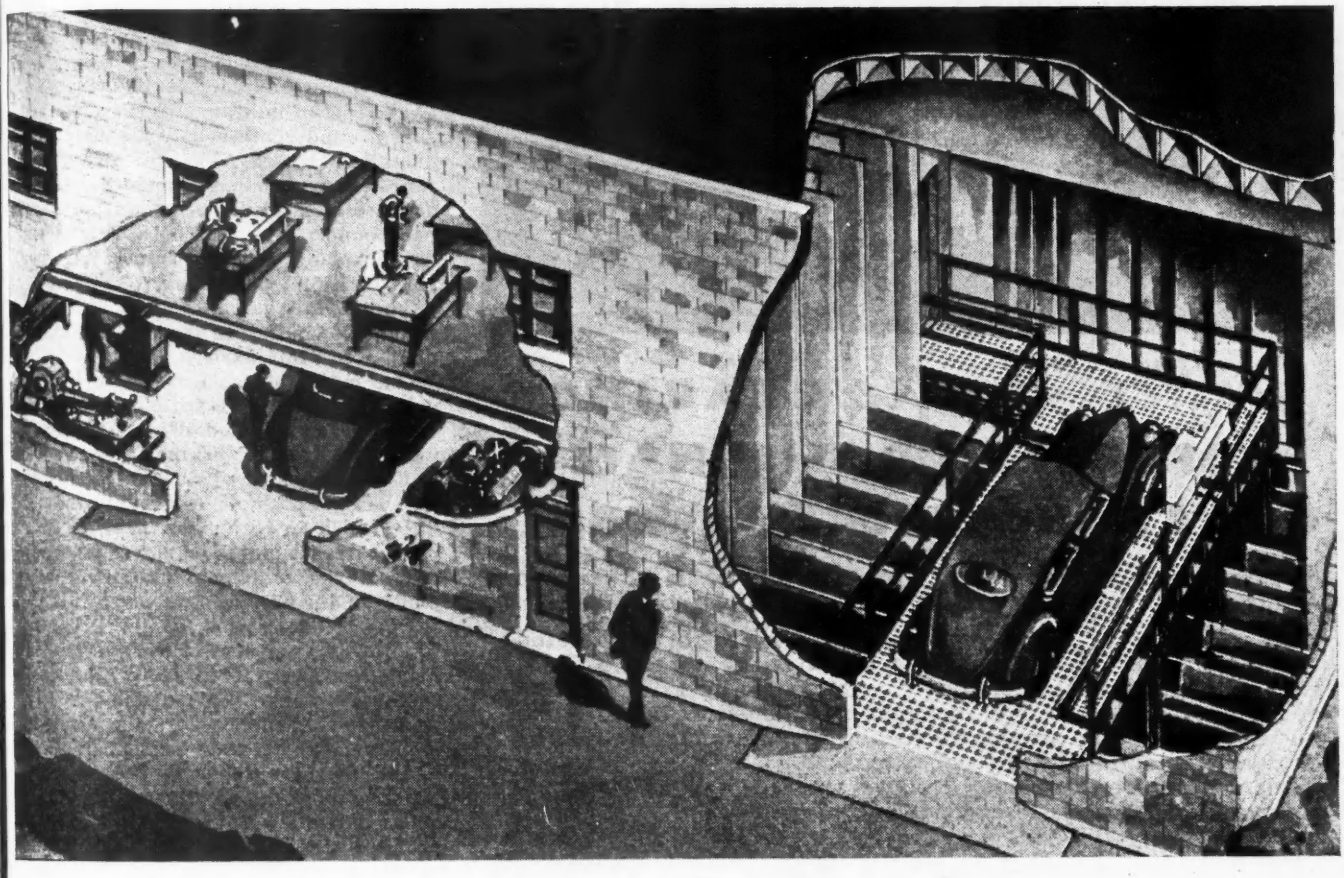
The American aircraft manufacturing industry produced a total of 300,317 military aircraft from Jan. 1, 1940, to Aug. 14, 1945. Production from Pearl Harbor to the end of the war was 274,941. Production during 1945 was at a drastically reduced rate and the 1944 record of producing 96,369 aircraft stands as an historic achievement. In one month, March of 1944, a total of 9117 military aircraft was produced. (The British, with a population one-third our own, produced very close to one-third our total of aircraft.)

From a total of 41 airplane, engine and propeller facilities in 1940, the industry expanded to a total of 81 factories plus 5 plants operated in Canada, a total of 86 in all, in 1943. Actual production floor space expanded from 13,115,000 square feet on Jan. 1, 1940, to 167,391,000 square feet in December, 1944. The gross value of aircraft production facilities mushroomed from $114,000,000 in 1939 to $3,906,000,000 in December, 1944.

A graphic picture of the aircraft production job is gained by data con-

(*Turn to page* 104, *please*)

SCHOOL FOR UNWANTED NOISES....



HERE at Hayes Industries, the automotive industry finds a potent new manufacturing and sales ally in this newly-built Sound and Wind Tunnel Laboratory, only other one of its kind in the U. S.*

In shielded quarters designed and dimensioned for exact sound wave frequencies, engine cooling fans, mufflers and other products can be engineered to meet all new requirements of engine speed, power, heat transfer, exhaust flow, body and chassis layouts.

Sound ranges from as low as 40 cycles up to highest frequencies—both beyond the human audible ranges—can be recorded and studied. Likewise wind-tunnel engineering facilities provide for both dynamic and sound research.

As originators of many pre-war improvements—and as wartime suppliers without stoppage, of hundreds of thousands of fans for jeeps, tanks, trucks and military vehicles—Hayes Industries is "ready and rolling."

HAYES INDUSTRIES INC.

JACKSON, MICH.

*Only other of its kind: RCA Laboratories, Princeton.

FANS · MUFFLERS · MOLDINGS · OTHER PARTS

cerning airframe weight which jumped from 24,600,000 pounds in 1940 to 1,110,700,000 pounds in 1944, an increase of 4400 per cent. The average weight of airframe produced increased from 4042 pounds in 1940 to 11,525 pounds in 1944.

Of the aircraft produced by the American aircraft industry, 15.2 per cent in 1943 and 16.2 per cent in 1944 were for Lend-Lease. From March, 1941, to Sept. 30, 1944, a total of 34,500 American aircraft were shipped to our Allies through Lend-Lease. Russia got 13,300 planes and Great Britain 9500.

The cost of military aircraft dropped sharply and continuously as their production increased. The cost of a giant, four-engined long-range bomber dropped from $15.18 per pound to $4.82 per pound. The cost of a single-seat fighter plane dropped from $7.41 per pound to $5.37 per pound.

The dollar value of total aircraft production increased from $342,000,000 in 1940 to $16,745,000,000 in 1944.

One major obstacle overcome by the industry in the race to expand output was the mobilization of thousands of workers. From a working force of only 48,638 persons in 1939, the army of aircraft plant employes grew to a peak of 2,102,000 in November, 1943. At this peak, aircraft plants employed 12.4 per cent of the total manufacturing employes of the nation.

During one period (July, 1944), a total of 36.9 per cent of the workers in prime contract of aircraft manufacture were women. More than 486,073 women were employed by the aircraft industry at the peak in November, 1943.

The aircraft industry, despite its wartime position as first in size and dollar volume output, had the lowest profit rate in relation to sales of any of the industries producing for war. In 1944 this rate was only 1.2 per cent net profit on sales. During this year the industry paid 71.7 per cent of its earnings to the Federal Government in taxes.

The aircraft industry in its prewar years was one of the most competitive in the nation. Companies jealously guarded their new designs, production methods, and "trade secrets." When war came, they had only one competitor: enemy aircraft production. So the West Coast aircraft manufacturers themselves formed the Aircraft War Production Council in Los Angeles in April of 1942. The East Coast manufacturers formed a similar group a few months later and in April, 1943, the two groups were merged into the National Aircraft War Production Council.

The record of this group fills tons of volumes but among their accomplishments was: by March, 1944, more than a million engineering manhours had been saved by the "pooling" of research data and production technique. More than 9000 technical reports were exchanged by the West Coast Council alone. A North American landing gear

(*Turn to page* 106, *please*)

N·A·S Internal Wrenching Bolts

Cold Forged by "National"

Applications subject to unusual stress, where extremely high torquing and fatigue resistance are required, call for NAS Internal Wrenching Bolts.

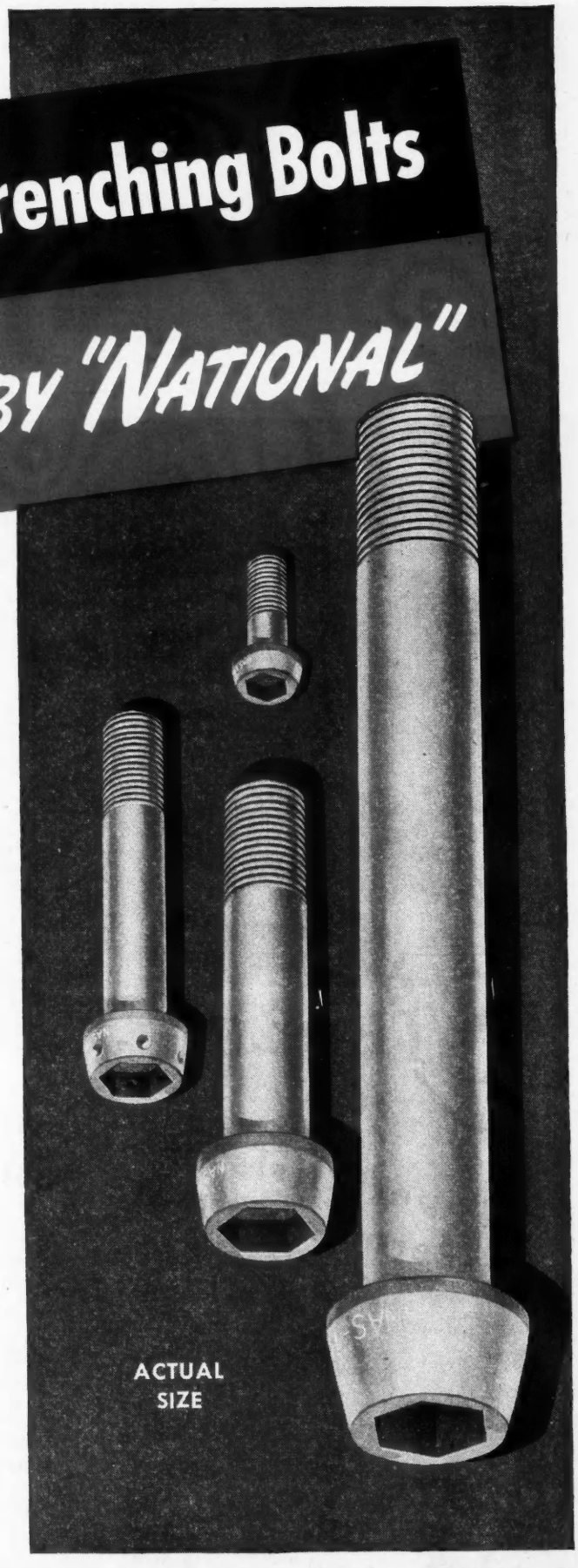
We make them from high-grade alloy steel, heat-treated to 160,000-180,000 p.s.i. tensile strength. The hex socket is cold forged (not machined), resulting in more uniform and better controlled grain flow of the metal. This method affords positive assurance of the *required strength on every bolt.*

Threads are made by the rolled thread process, producing an unbroken grain flow and consequently greater strength. Thread runout at the grip has a rounded root, thereby avoiding the sharp stop caused by other methods of threading.

The entire shank, underside of head and radius have ground surfaces.

"National's" close co-operation with engineers of the aircraft industry in the progressive development and improvement of Internal Wrenching Bolts has made us a prime source of supply for these important aircraft fasteners.

National Headed and Threaded Products



THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

went into the Northrop P-61 Black Widow. A Vultee wing flap went into North American P-51 Mustang. A Boeing power plant went into the Consolidated B-32 Dominator. Lockheed furnished 380,000 square feet of aluminum alloy sheet to Vultee and Consolidated. More than 20,600 items were exchanged plus 45,000 items furnished to companies outside the council. This was the type of cooperation that created the greatest aerial fleet in all history.

Pooled Production

In addition aircraft companies made available their patented products and their engineering data so that other aircraft companies and automobile, refrigerator and typewriter firms could help produce planes and engines. Here is a brief summary of the "pooling" of production by the major units of the nation:

B-29 Superfortress: made by Boeing, Bell, Martin.

B-17 Flying Fortress: by Boeing, Douglas, Lockheed.

B-24 Liberator: by Consolidated Vultee, Douglas, Ford, North American.

Corsair: by Vought, Brewster, Goodyear.

Wildcat: by Grumman, General Motors.

Avenger: by Grumman, General Motors.

Hell-diver: by Curtiss, Fairchild (Canada), Canadian Car & Foundry.

P-38 Lightning: by Lockheed, Consolidated Vultee.

Pratt & Whitney engines: by Pratt & Whitney, Nash-Kelvinator, Buick, Chevrolet, Ford, Continental, Jacobs.

Wright engines: by Wright, Dodge, Studebaker, Continental.

Hamilton Standard propellers: by Frigidaire, Nash-Kelvinator, Remington-Rand.

These are simply production of completed articles. Literally hundreds of thousands of firms participated in the production of parts, sub-assemblies, equipment and supplies. Even basement workshops were utilized. Aircraft production was truly a national effort.

Pontiac's Expansion Plans

Pontiac Motors Div. of G.M. has announced plans for a $30 million expansion program designed to boost production of cars to $500,000 a year and employment to 16,000. Best previous year was 1941 when 330,061 cars were produced and employment stood at slightly more than 11,000. The expansion will add 1,100,000 sq ft of floor space.

Scheduled for enlargement are the foundry which alone will cost more than $3 million, the engine plant, axle building, assembly plant, sheet metal unit, and heat treating and shipping departments. A large plant which was erected in 1942 for the manufacture of torpedoes already has been converted into a parts depot. In addition to assembly operations at Pontiac, the division also will provide parts for six General Motors assembly plants throughout the country where Pontiacs will be assembled along with Buick and Oldsmobile cars. These include the two plants at Linden, N. J., and Southgate, Cal., which were in operation before the war.

Disposition of Chrysler Tank Arsenal Settled

Disposition of the huge Chrysler tank arsenal has been settled with the announcement that it will be turned over to the Army Ordnance Dept. In addition, Chrysler has announced that it is turning back to Packard Motor Car Co. the proving ground at Utica, Mich., which it had leased for testing army vehicles.

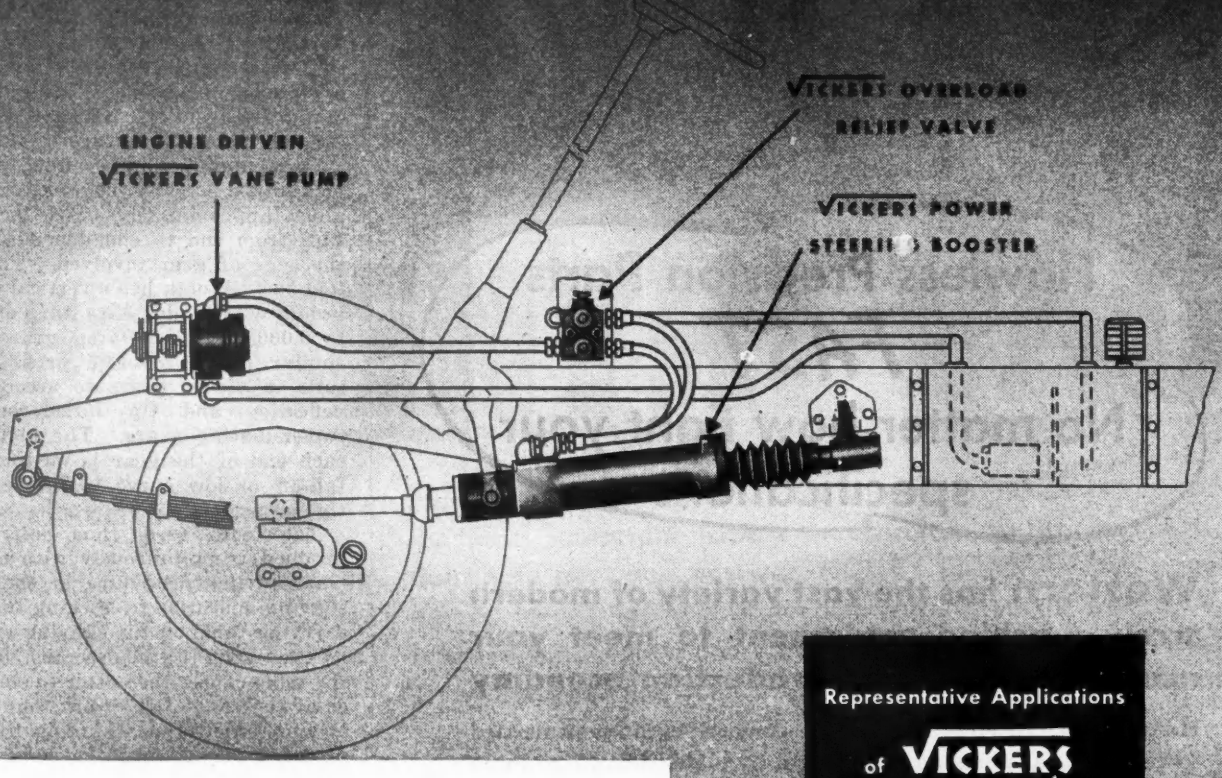
Brig.-Gen. Walter P. Boatwright, commanding officer of the Office of Chief of Ordnance, Detroit, has stated that his organization hopes eventually to move its entire staff to the arsenal and to make it a permanent testing and research laboratory for combat vehicles. Chrysler turned out more than 25,000 tanks at the arsenal, with peak production reaching more than 1000 units a month.

Arnold Appoints Arrow

Arnold Motor Company, Warsaw, Ind., maker of "Ivalites," the flexible, automotive spotlights with fully rotating heads, has appointed Arrow Safety Device Company, Mr. Holly, N. J., as exclusive distributor of its automotive models.

COMPACT·

Another Important Advantage of VICKERS HYDRAULIC POWER STEERING



Requiring only a minimum of space for installation, the Vickers Hydraulic Power Steering System can be applied to most existing hand steering mechanisms with a few simple alterations. The separate power cylinder (booster) can be located where it does not interfere with other apparatus and where the power will be applied directly to (and in line with) the drag link. No additional space is required at the end of the steering column where space is usually at a premium.

Other important advantages of Vickers Hydraulic Power Steering are: effortless, positive and shockless steering . . . road shock thrusts are transmitted to the frame of the vehicle instead of to the steering gear . . . automatic overload protection . . . reduced operator fatigue . . . greater road safety . . . automatic lubrication . . . and 15 years of successful operating experience. Bulletin 44-30 gives complete information about Vickers Hydraulic Power Steering; write for a copy.

VICKERS *Incorporated*

Application Engineering Offices: CHICAGO • CINCINNATI • CLEVELAND • DETROIT
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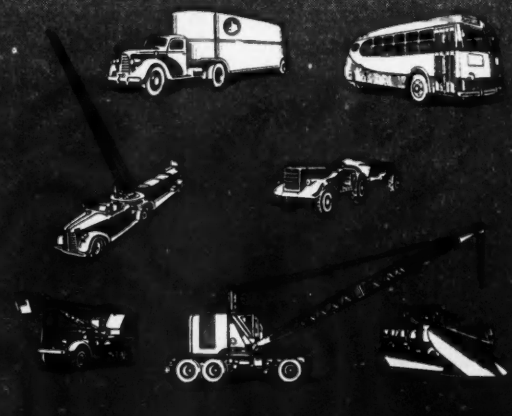
TULSA • WORCESTER

Representative Applications of VICKERS HYDRAULIC POWER STEERING



Elliptoidal Shaving Of Gear Teeth

(*Continued from page* 21)

deflection in the mechanism under severe overload conditions. The role of elliptoid shaving, therefore, is to prevent stress concentrations wherever they may be engendered. That marks the real factor of safety responsible for long life and durability in heavy duty service.

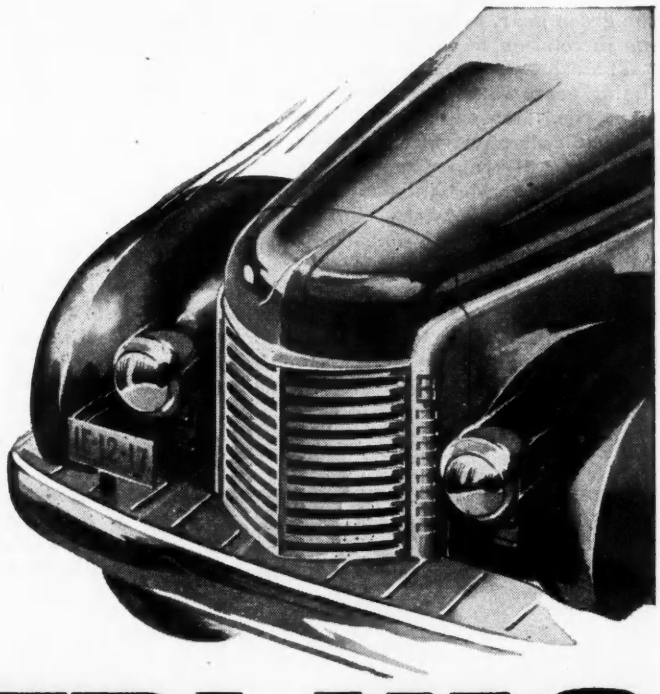
The elliptoid tooth form developed by National Broach and Machine Co. engineers is produced on Red Ring gear shaving machines and is applicable to both spur and helical gears. It stems from the recognition that it is most important to have a plus curvature on the surface at the center of contact thus avoiding end bearing. The amount of curvature from the center to the ends depends upon the nature of the application and is determined experimentally. At IHC our practice is to allow approximately 0.001 in. curvature from end to end depending upon the type of gear involved. The elliptoid shaved tooth has a vertical involute profile with a plus curvature of 0.0002 to 0.0003 in. on driving gears and a similar minus involute profile curvature on driven gears to accommodate deflection and tip interference between mating gears. The involute at each end of the gear is modified by a fall-off or low curve to further avoid tip contact.

The tooth form thus described is produced simultaneously with the normal shaving procedure in the rotary shaving operation by rocking the work-carrying table on the shaving machine, as the cutter is reciprocated. Rocking the table causes the cutter to sink deeper at the ends of the work than it does at the center, thus thinning the tooth progressively toward the ends. Maximum tooth thickness location can be controlled by positioning of the work on the table. The amount of crowning as well as the location of the contact area can be controlled at will by the cam setting at the end of the table. It is important to note that the operation of elliptoid shaving requires no more machine time than does conventional shaving.

We have selected two different types of transmission gears to illustrate the uniqueness of the manufacturing problems involved. The first of these is the clutch shaft, in which we have an open end gear at the end of a long shaft. Owing to the cavity at the end, the cross-section must be carefully proportioned so as to afford uniformity of section to avoid heat distortion. Even so, special precautions must be taken to avoid distortion. At IHC this type of gear is carefully quenched using a serrated plug at the end to prevent the metal from shrinking inwardly. Whatever minute heat treat distortion still remains, is completely neutralized by elliptoid shaving of the tooth profile in

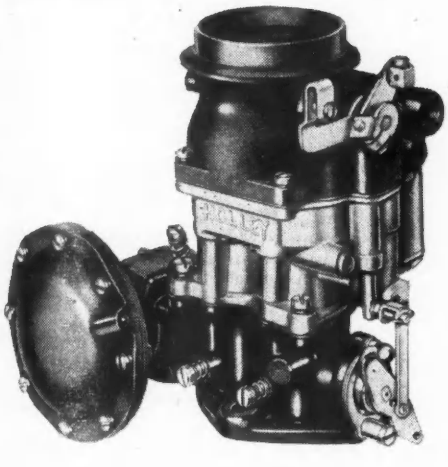
(*Turn to page* 110, *please*)

Protect your New Truck with



Holley CENTRI-VAC

- **Reduces Accidents**
- **Saves Engine Wear**
- **Cuts Fuel Costs**



Protection of expensive motor truck equipment is one of the most important factors in efficient, profitable operation, both now and postwar. HOLLEY CENTRI-VAC is engineered to provide this protection without sacrificing quick, positive acceleration and other desirable operating qualities. This new governor principle controls engine speed without surging, loss of power or sluggish pickup.

Conserve equipment, reduce accidents and cut operating and maintenance costs with CENTRI-VAC control. While providing greater safety, CENTRI-VAC assures more constant speed, which makes for faster schedules and better road time.

Investigate CENTRI-VAC'S extra safety factors, low cost and easy installation . . . write today for complete information and comprehensive engineering data.

HOLLEY CARBURETOR COMPANY
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the green gear, by positioning the bearing in relation to the tooth face width.

The other example is the first speed sliding gear, which typifies large dimensions and mass effect. Here, mechanical design provides the proper proportioning of section, easy tapering of the web, etc., to minimize heat treat distortion. In heat treatment at IHC, a gear of this type is quenched on an arbor in the familiar Gleason quenching machine, using a serrated plug in the center bore. Despite all precautions that may be taken, this gear is so severely loaded under extreme operating conditions, such as in dump trucks, that elliptoid shaving is essential to prevent end bearing concentration when the transmission case deflects under the heavy load.

Following is the complete sequence of operations used in producing the two gears mentioned above. Briefly, the current procedure for all bored gears is to start with a carefully broached bore in the forging so as to effect a basic location for all subsequent machining and gear cutting operations. The gear teeth are single-hobbed, then elliptoid shaved in the green. Since the adoption of elliptoid shaving, the production department reports a distinct reduction in rejects and minor rejections in finish assembled transmissions.

Clutch Shaft Routing

OPERATION AND EQUIPMENT

Cut stock to length—Small **Buffalo shears.**
Upset—5 in. Upsetter.
Cold trim flash—1¼ **Ajax Upsetter.**
Cycle anneal—**No. 2 Hagan Furnace.**
Tumblast to clean—**American Wheelabrator**
Mill stem end to length & center both ends—**Jones & Lamson mill.**
Inspect.
Rough turn & chamfer pilot diameter, stem diameter, thread diameter, and large bearing chamfer, and face back face of gear; finish turn and chamfer pilot diameter, stem diameter, thread diameter and large bearing diameter, and finish face back of gear & cut three recesses—**Monarch Automatic lathe.**
Green grind pilot bearing diameter—**Norton grinder.**
Spot drill 69 deg. angle rough and finish turn external OD, rough & finish face to length; rough and semi-finish & finish bore internal teeth diameter. Rough & finish bore & ream bearing diameter, center drill, cut recess at end of bearing. Rough and finish face bearing depth, chamfer internal tooth ID and OD of gear—**Conomatic.**
Green grind spline diameter; finish green grind large bearing diameter—**Norton grinder.**
Green grind internal teeth bore—**Heald Sizematic grinder.**
Drill three oil holes and burr both ends of oil holes—**Delta single-spindle drill.**
Mill 2 lock slots—**Pratt & Whitney hand mill.**
Rough form chamfer and recess 16 internal teeth and remove burrs from back of 16 internal teeth and 3 oil holes—**Cross gear tooth chamfering machine.**
Semi-finish hob 22 helical teeth and stamp part number—**Cleveland hobber.**
Finish hob 10 splines—**Barber-Colman hobber.**
Finish cut 16 internal teeth—**Fellows gear shaper.**
Chamfer acute angle on both ends of helix teeth—**Cross gear burr machine.**
Finish elliptoid shave 22 tooth helical gear—**Red Ring Gear Shaver.**
File burrs from both faces of 20T helical gear and both ends of internal gear teeth—Bench & Burr head.
Wash—**Automatic Washer.**
Inspect.
Carburize—**No. 2 Holcroft furnace.**
Quenched on plug—**Gleason Quench Press.**
Draw—**No. 1 Homo Furnace.**
Wheelabrate to clean—**American Wheelabrator.**
Clean centers—**Burr head.**
Straighten to 0.001 in. limit—**Power Press.**
Inspect.
Finish grind stem and spline diameter; finish grind main bearing diameter and shoulder; finish grind pilot bearing diameter—**Norton external grinder.**
Finish grind bore for bearing diameter—**Heald Sizematic grinder.**
Grind threads—**Sheffield thread grinder.**
Remove nicks from spline—Bench.
Wash—**Automatic Washer.**
Inspect.

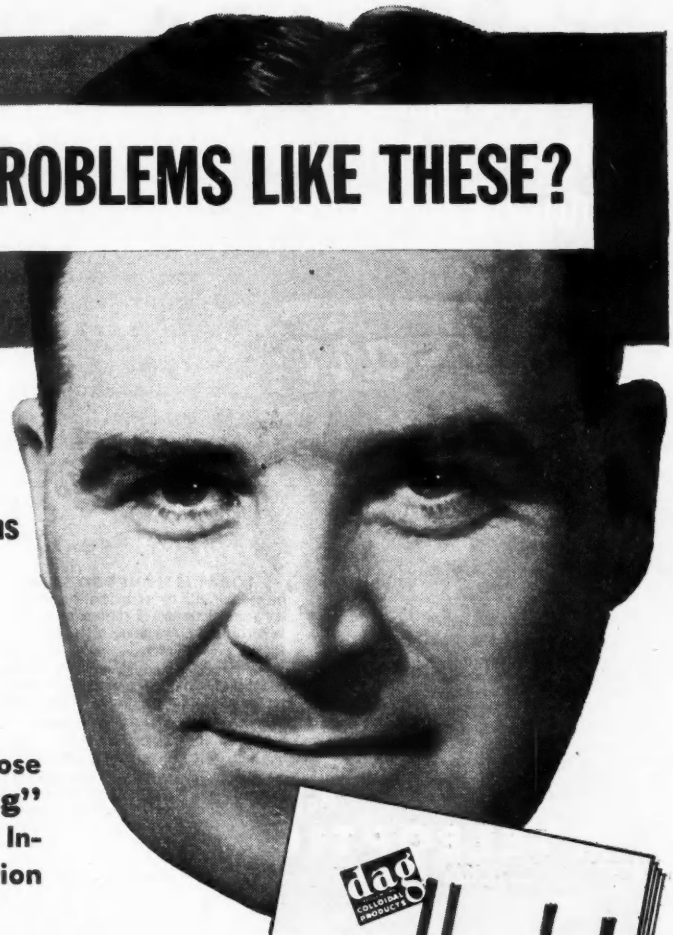
First Speed Sliding Gear Routing

OPERATION AND EQUIPMENT

Cut stock to length—**Pels Shears.**
Forge, punch out center and trim flash—No. 2—5000 lb. hammer.
Load and unload furnace, load and unload chain conveyor and mark up chart—**No. 2 Hagan furnace.**
Shotblast to remove scale—**American Wheelabrator.**
Inspect.
Drill hole for broach—**4-spindle Foot-Burt Drill Press.**
Finish broach round hole and rough broach splines; finish broach splines (2nd pass)—**American Hydraulic Broach.**
Press arbor into gear blank—**Power Press.**
Rough and finish turn OD and shift groove OD and rough and finish straddle face gear and hub to width, file burrs from both ends of spline; cut shift fork groove and chamfer flange. Chamfer large gear diameter; remove burrs and break sharp edge on large gear ID—**Fay Automatic Lathe.**

(Turn to page 112, please)

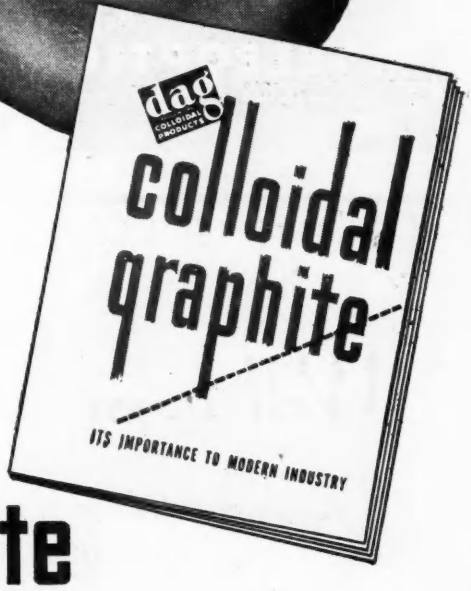
NEED SOLUTIONS TO PROBLEMS LIKE THESE?



- Lubricant to Prevent Distortion in Drawing Piston Rings
- Mold Lubricant for Casting Aluminum Pistons
- Assembly and Run-In Lubricant
- Controlling Static Electricity
- Dry Film Lubricant for Radio Instruments

SOLUTIONS to many of your problems like those checked above will be found in the booklet **"dag"** Colloidal Graphite — Its Importance to Modern Industry . . . available on request without obligation by simply mailing the coupon below!

As an industrial trouble-shooter, versatile **"dag"** Colloidal Graphite (not a single product but actually many products in one) has a number of unusual and valuable applications. A good many of these applications are recent developments of the war years. If you are not absolutely certain that you know all of these later applications—and how they may help you—let a 3¢ stamp bring you up to date.



dag REG. U.S. PAT. OFF. **colloidal graphite**

ACHESON COLLOIDS CORPORATION, Port Huron, Michigan

TO GET THESE:

This new literature on **"dag"** colloidal graphite is yours for the asking:

- 430 — A general booklet on the story of **"dag"** colloidal graphite. 12 pages profusely illustrated.
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No. 431 ☐ OUR PRESENT OIL SUPPLIER IS _____
No. 432 ☐ (Lubricants containing **"dag"** colloidal graphite are available from major oil companies.)

Burr end of splined fork flange end; burr end of splines—other end—**Delta Drill.**

Semi-finish hob (50T) spur gear and stamp part number—**Barber-Colman Hobbing Mach.**

Round both ends of 50 spur teeth—**Cimatool Tooth Rounder.**

Finish elliptoid shave 50 spur teeth and stamp part number—**Red Ring Gear Shaver.**

File burrs from facing OD of hub and ID of web both side of gear and file burr from OD of shifting fork groove flange and hang on power conveyor—**Burr Head.**

Wash, inspect.

Carburize—**No. 2 Holcroft furnace.**

Quench comb plug and die—**Gleason Quenching Press.**

Draw—**No. 1 Homo furnace.**

Shot blast—**American Wheelabrator.**

Inspect.

Finish grind bore and spot check gear for runout at pitch diameter and face—**16A Bryant Internal Grinder.**

Grind nicks from end of splines—**Bench.**

Finish grind shift fork groove—**Heald Grinder.**

Polish shift fork groove—**LeBlond Lathe.**

Wash—Automatic Washer.

Inspect.

In keeping with the concept of quality at IHC, the metallurgical laboratory makes sampling tests of finished transmissions picked at random from the assembly lines. These are tested on a transmission dynamometer testing stand in accordance with procedures specified by the Engineering Department. In addition the transmissions are subjected to other tests in the complete vehicle on the chasis dynamometer. Thus we have a constant control of quality under conditions which are more severe than any encountered in actual service.

To supplement these final controls, the gear department has a complete gear laboratory for checking gears in process. Gears in the green are percentage checked by selecting random samples. Pairs of such gears are run in the Gleason testers to show alignment and correct contact area and location of contact. After heat treatment, gears are run through Red Ring gear speeders 100 per cent to check the contact area.

In conclusion it may be observed that the adoption of modern methods of gear production, coupled with advanced mechanical design and metallurgical control, has yielded exceptional results by way of customer satisfaction and production economy. There is no doubt that the adoption of elliptoid shaving has paved the way to the neutralization of the uncontrollable elements in transmission manufacture which have been responsible for the occasional but troublesome service difficulties.

Steel Shipments

(*Continued from page* 42)

the tin market that early relief is in sight. No fault is being found with WPB efforts to encourage the use of secondary tin wherever it will serve its purpose, but there are many in the trade who consider the outlook for tin supplies in 1946 as reassuring. President Villaroel of Bolivia recently stated that Bolivia would reduce its tin exports to 30,000 tons next year, the present rate being slightly more than 42,000 tons a year. Some tin importers have read into the Bolivian president's statement cautiousness lest easing prices cut sharply into the tax revenue.


CUT NUT-TURNING COSTS WITH THE RIGHT WRENCH FOR EVERY OPERATION!
In every phase of production, assembly and maintenance more millions of man-hours are spent in *nut turning* than in all other hand tool operations combined. On any job the *right wrench* will make significant savings . . . and on many jobs time costs can be cut to a fraction . . . with greater accuracy, less effort, utmost safety! Check nut-turning operations right through your plant — replace worn, obsolete, mis-fit "slow-downers" with the right Snap-on for each job. Send for complete catalog covering the most advanced wrench equipment of every type. Write
SNAP-ON TOOLS CORPORATION
8054-I 28th Ave., Kenosha, Wis.
Snap-on Tools
THE CHOICE OF BETTER MECHANICS

New Products

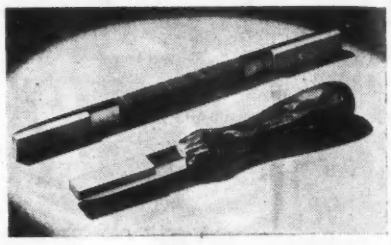
(*Continued from page* 60)

snap gage to its line of gages. This is a single-purpose type of gage, the dial of which is graduated in .0001 in., has a range of .008 in., and can be made to suit any dimension between ⅛ in. and 1½ in. It weighs approximately seven oz.

The weight of the gage rests on the rigid upper anvil, therefore, it cannot influence the indicator reading. The lower anvil is a flexible, solid piece of metal which transfers the variation in the dimension from the workpiece to the dial Indicator. Both anvils are tungsten carbide tipped for long wear. It has an insulating finger grip.

Bay State Pocket-Size Diamond Hand Hones

Two pocket-size Bay State vitrified diamond hand hones are being offered to the trade by the Bay state Abrasive Products Co., Westboro, Mass. These



Bay State vitrified diamond hand hones

diamond hand hones are said to be exceptionally good for touching up carbide tools before they become too dull, keeping them sharp for most efficient cutting and prolonging tool life.

Both pocket-size models are available with a diamond section 7/16 in. wide by 1 in. and 1½ in. long with 1/16 in. depth of diamonds. They are supplied with plastic handles and each is furnished in a leather pocket case. One model has a hone at both ends, the other a hone at one end.

Non-Phenolic Type Cleaner and Degreaser

Gerlach 60 degreaser, made by E. A. Gerlach Co., Philadelphia, Pa., is a general purpose chemical "cold" cleaner for degreasing and cleaning metals and for general automotive, aviation, commercial, and industrial cleaning. It has emulsifying properties so that kerosene, gasoline or oil mixed with Gerlach 60 degreaser will in turn mix with water. A pressure water rinse, therefore, readily washes off all grease and oil which has been loosened from the surfaces being cleaned.

Gerlach 60 degreaser is said to be harmless to all metals, painted surfaces, hands and clothing. It is non-inflammable.

Coats Wire Against Rust

Nox-Rust Corp., Chicago, Ill., is releasing information on Nox-Rust No. 66, which keeps steel and galvanized wire free of corrosion. An invisible coating of the new material is said to keep wire and sheet metal bright as new.

Free-Machining Tool Steel

Faster machinability is provided by a new tool steel developed by the Allegheny Ludlum Steel Corp., Brackenridge, Pa. The new product, identified as "Dunkirk EZ," is a free-machining steel and is described as being "outside the usual tool steel specifications, with extraordinary possibilities in the fields of cold work applications and tool steel machined parts, such as dies, gages, forming rolls, bushings, liners, and bodies for multiple-edge tipped tools." Its free-cutting qualities make it adaptable for tool steel parts turned out on screw machines and turret lathes, where

(*Turn to page* 116, *please*)

TESTS PROVE the superiority of

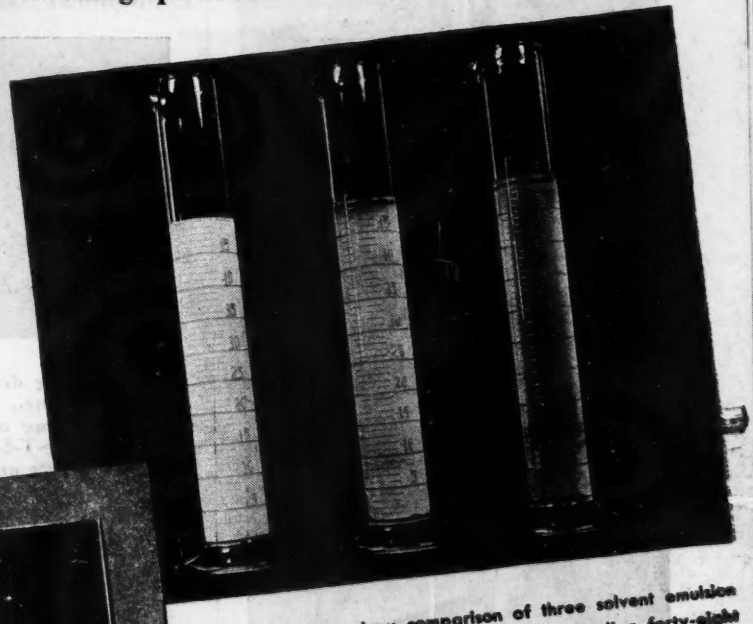
PENNSALT CLEANER EC-10

U. S. PAT. NO. 2374113

. . . A New Emulsion-Type Cleaner

A *SINGLE* *OPERATION* QUICKLY FREES METAL PARTS OF DIRT, OILS, GREASES, METAL CHIPS!

Embodying a new principle, Pennsalt Cleaner EC-10 actually removes some types of soil which alkaline cleaners won't budge in the short time today's stepped-up production demands. Smut deposits, together with lubricants, tripoli, rouge and various metal finishing agents many times require lengthy, time-consuming cleaning operations.



These graduates show comparison of three solvent emulsion cleaners, diluted 1:50 with water. After standing forty-eight hours No. 1 (Pennsalt Cleaner EC-10) shows a thick dense emulsion, while No. 2 and No. 3 show considerable separation. This test demonstrates the high degree of stability of Pennsalt Cleaner EC-10 in water emulsion.

A strip of polished aluminum contaminated with shop dirt and fingerprints was dipped in a solution of Pennsalt Cleaner EC-10. The picture shows the result after a portion of the strip had been dipped in concentrated EC-10 for thirty seconds, then cold water rinsed.

Use Pennsalt Cleaner EC-10 for:

1. Spray washing and rust inhibiting in one operation
2. Precleaning before alkaline cleaning and subsequent plating
3. Cleaning before painting
4. Cleaning painted surfaces
5. Grease and oil removal from any metal surface

SPECIAL CHEMICALS DIVISION PRODUCTS

Acid-, Alkali-, and Solvent-proof Cements • Lead Fluoborate Concentrates • Fluoboric Acid • Acid, Alkali and Solvent Emulsion-Type Cleaners • Paint Strippers • Pickling Agents.

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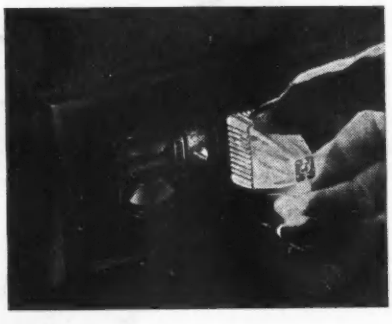
fast machining is desirable. In addition, the comparative ease with which the new metal is worked provides longer life for the tools used in working it.

"Dunkirk EZ" will harden to about 65 Rockwell C when oil quenched from 1450-1550 F.; may be tempered up to 500 F. without softening under 60 Rockwell C; is rather deep-hardening, which assures proper hardness even in large sections; undergoes very slight dimensional change in heat treatment; and possesses higher impact and transverse rupture strength than most other oil-hardening tool steels.

For special application such as brake dies, Dunkirk EZ can be supplied in the form of bars, blocks, rings, dies, etc. in the normalized condition at 250-275 Brinell at which hardness good machinability is still obtained.

Economical Safety Light

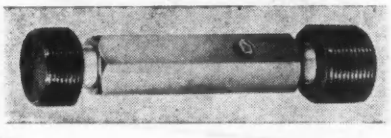


This lighting device, originated by Littelfuse Inc., Chicago, Ill., fits any wall plug or electrical outlet. Named Nite-T-Lite, it illuminates danger points and indicates the location of lamps or electric light switches. Cost of operation is said to be less than a cent a month. Nite-T-Lite has exceptionally long life.

Hard Alloy Thread Gages

The Master Gauge Company, Detroit, Mich., is now manufacturing a line of thread plug gages of Tantung, a nonferrous alloy.

Tantung is a hard, strong, tough alloy containing cobalt, tungsten, chromium and tantalum-columbium carbide. The latter is said to impart a self-lubricating action which increases its resistance to wear. Tantung is dense and fine grained, and takes a high finish. It is non-magnetic and is not corroded by moisture or any of the common acids or fumes.



Thread plug gage made by Master Gauge Co.

(*Turn to page* 118, *please*)

ONLY Bendix HYDRAULIC POWER STEERING combines all of these features

Bendix Power Steering shown in combination with Ross steering gear.

Here in one compact unit, simple in construction and operation, Bendix offers a solution to even the most difficult steering problems.

The all-important factor of safety is immeasurably increased with the Bendix Hydraulic Power Steering Unit. When soft shoulders, road obstructions or even tire blow-outs are encountered the automatic operation of the control valve assures instant and complete steering control. There is no need to "fight the wheel" for Bendix Hydraulic Power Steering supplies instant added steering power to meet even these emergencies.

Safety is further increased by greatly reduced driver fatigue. With Bendix Hydraulic Power Steering, busses, heavy duty trucks and road graders are far safer to operate and drive.

No special mounting is required as the completely housed unit is installed with the same type of mounting used with conventional gears.

And remember, too, the Bendix Hydraulic Steering Unit has been performance tested on the toughest proving ground in the world. Tank retrievers and armored cars on all the fighting fronts have been equipped with this same Bendix Hydraulic Steering Unit.

For further information write to

BENDIX PRODUCTS DIVISION • SOUTH BEND 20, IND.

Bendix AVIATION CORPORATION

SAFER, SURER, CONTROL

Loss of control prevented by automatic operation of the control valve.

REDUCED DRIVER FATIGUE

Finger-tip control assures easy steering for the heaviest vehicles.

NO ROAD SHOCKS

Immediate hydraulic response resists all road shocks.

PERFORMANCE PROVED ON THE TOUGHEST JOBS

Bendix Hydraulic Steering is used on war vehicles, tank retrievers and armored cars.

DESIGNED TO YOUR REQUIREMENTS

Steering wheel effort may be reduced to any desirable degree.

Bendix PRODUCTS DIVISION

Silicone Rubber

Dow Corning Corp. announces the commercial availability of Silastic, a silicone rubber, produced in various stocks for molding, extruding, coating, and laminating. Largely because of their inorganic origins, these rubbery organosilicon oxide polymers are said to remain elastic after heating at temperatures up to 500 F. and retain flexibility at temperatures as low as −70 F.

Silastic stocks are available for molding flat sheets, gaskets and other shapes. Silastic coated lead wire and other continuous extruded shapes are made from Silastic stocks designed for extruding.

Also available are Silastic stocks compounded for coating glass or asbestos cloth to produce gaskets, diaphragms, tape and electrical insulation which is nontracking, arc and oxidation resistant.

Battery Electric Vehicle

(*Continued from page* 36)

radius arm at each side above an inverted half-elliptic spring. At the rear the springs are transverse quarter-elliptics, extending from the center of the rearmost cross member, to which their butt ends are bolted. To the same cross member the casing of the 4 to 1 spiral bevel final drive is bolted, transverse Cardan-joint shafts to the rear wheels.

The electric motor is located between the parallel tubes of the frame, close to the final drive, to which it is coupled by a short flexibly jointed propeller shaft. Steering on this model is of the rack and pinion gear type. Brakes are Bendix. Wheels have 16 in. rims for 6 in. tires. The hand-operated drum controller includes a brake inter-lock system. Rheostatic braking will be optional.

Types of body for this 1-ton model will be an orthodox panelled van and a step-in (sit-or-stand drive) van for door-to-door deliveries. The load capacity in both bodies is 180 cu ft (90 in. long, 62 in. wide and 55 in. high).

What is described as a special lightweight lead-acid battery has been developed. Located under a hood at the front, it is of 200 amp-hr capacity with 40 cells. On undulating as distinct from hilly roads the range is said to be from 40 to 45 miles with the battery fully charged and a maximum speed of 18-20 mph.

The 2½-ton (5000 lb) load capacity model differs from the smaller type in several important respects. For example, it has a single tubular "backbone" frame; there are two motors, one at each side, each driving the adjacent rear wheel directly through worm gearing. Helical springs, instead of quarter-elliptics, are used for the independent rear suspension. The front suspension is the same as that of the 1-ton model.

The motor at each side is constructed as a unit with the worm drive casing. The front end of this unit is pivoted to an outrigger cross member of the frame, welded to the tubular backbone, while the rear (worm drive) end is bolted to the brake anchor plate through which runs a solid drive shaft to the adjacent rear wheel. No mechanical differential is fitted or required; instead, an electrical "differential" or balancing system is employed to prevent one motor being excessively overloaded in the event of the other being subject to higher electrical resistance. The same size of battery as in the smaller model is used, but is duplicated, one unit at each side of the chassis. The range on a full charge is approximately the same for both models, but the maximum speed of the 5000 lb model is less; i. e., 14-16 mph. Open truck and panelled van bodies are to be standardized. The following are some dimensions, etc.:

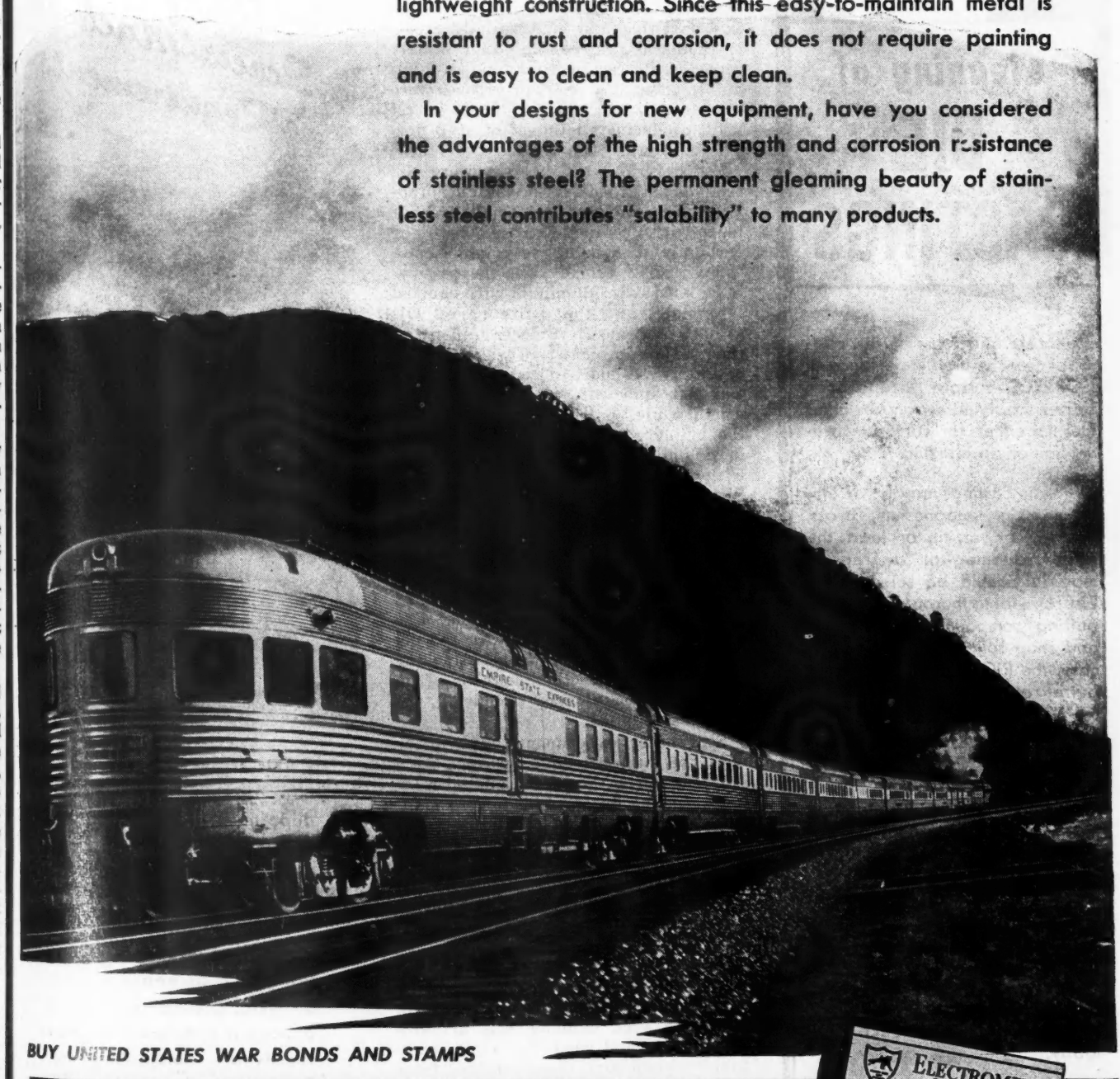
Model	1-ton	2½-ton
Wheelbase	115 in.	110 in.
Tread	54 in.	59 in.
Turning circle	37 ft.	44 ft.
Mean ht. of load platform	26 in.	39 in.
Chass. wght. without bat.	1,300 lb.	2,130 lb.
Overall length	189 in.	189 in.
Overall width	69 in.	72 in.

Stainless Steel

for Lightweight Equipment

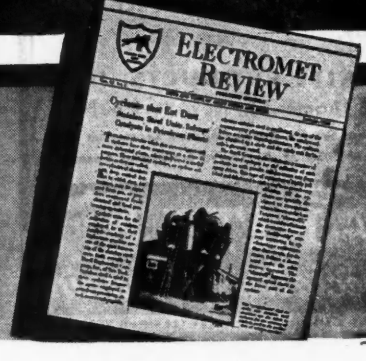
Ten years of experience with stainless steel equipment on many railroads has proved the value of stainless steel in lightweight construction. Since this easy-to-maintain metal is resistant to rust and corrosion, it does not require painting and is easy to clean and keep clean.

In your designs for new equipment, have you considered the advantages of the high strength and corrosion resistance of stainless steel? The permanent gleaming beauty of stainless steel contributes "salability" to many products.



BUY UNITED STATES WAR BONDS AND STAMPS

Other interesting uses of stainless steel are described in ELECTROMET REVIEW, published by ELECTRO METALLURGICAL COMPANY, the Unit of UNION CARBIDE AND CARBON CORPORATION that produces alloys for making steel. If you need this publication, send your name on your business letterhead to ELECTRO METALLURGICAL COMPANY, Room 328, 30 East 42nd Street, New York 17, N. Y.



Fin Development

(*Continued from page* 26)

flexibility in fin thickness and spacing, and preliminary studies indicated that for the engine under test, fins spaced 10 per inch and 0.030 in. thick would give the most desirable results, and several such muffs were prepared. To permit the muff to pass over the threads used for attaching the cylinder head, it was necessary to have the outside diameter of the barrel larger than the diameter of the thread, and this resulted in a wall thickness substantially greater than was desired. This immediately introduced a factor of excessive weight, and to offset it a series of grooves were machined in the outer cylinder barrel wall, producing the effect of stub fins. The muff was then shrunk over these ribs. Several such barrels were assembled and tried out on test, but, probably on account of the small area of fin-to-barrel contact, excessive heat was encountered, causing very rapid ring wear. To overcome this, the grooves were filled with aluminum wire caulked into place, and the entire barrel OD ground to a smooth surface. Muffs were then shrunk in place, and while the test results were more encouraging there was not sufficient improvement to be worth while. Moreover, the weight of the cylinder was increased about one lb. Similar experiments were made with statically cast and with centrifugally cast muffs; static castings were found to be prone to cracking due to the stresses imposed by the shrink operation. Cylinders were sectioned after test, and showed evidence of chafing between the barrel and the muff. Any further developments along this line seemed to require a change in the design of the cylinder head attaching thread, and since other methods of fin attachment looked more promising, the idea was dropped.

Still other experiments were made with the muff principle, using a solid muff cast on to the barrel, and with integral cooling fins machined in the muff. A successful means of bonding the steel to the aluminum was worked out, but considerable difficulty was encountered in cutting the fins. These were spaced 10 to the in., and were one in. deep by 0.030 in. thick. Hard spots in the castings jammed the tools on several occasions and caused the entire muff to peel off, but this trouble was overcome by changing the fin pitch to 9.0 per in. Only one such cylinder was actually run on test, and while the results were found satisfactory, those obtained from experiments with mechanically attached sheet metal fins seemed to offer so much greater promise that further work on the cast muff type was abandoned.

One method of attaching sheet aluminum fins was by cutting a continuous spiral groove in the barrel wall. This was cut to a depth of 0.090 in. and width of 0.030 in., with a 10 pitch.

(*Turn to page* 122, *please*)

CLEARING THE WAY...THAT OTHERS MIGHT ROLL

Bendix-Westinghouse points proudly to thousands of Air Brake and Air Control installations which have performed such a vital role by adding immeasurably to the efficiency and economy of those various units engaged in highway maintenance ★ Although it is a far cry from today's summer sun to the snow-clogged roads of winter, Bendix-Westinghouse accepts this opportunity to congratulate the men who are engaged in this around-the-clock service. Theirs is a Herculean task all too often overlooked and one which shows to such splendid advantage the rugged dependability of genuine Bendix-Westinghouse Controls under the most grueling conditions of operation ★ Naturally your service is different, but it's a safe bet that genuine Bendix-Westinghouse Air Brakes hold many advantages you may be missing ★ Specify this "World Standard of Safety" when ordering new equipment or modernizing units now in service. See your nearest authorized Bendix-Westinghouse Distributor... he's a good man to know and one whose broad knowledge of controls is yours without obligation.

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Aluminum sheet stock was then fed into the groove while the cylinder revolved in a lathe, and a tool upset one side of the land to form a dovetail lock. This method of assembly was relatively easy, but the production of the spiral groove gave considerable trouble due to narrowness of the tool. Attempts were made to grind the groove from the solid on a standard thread grinder, but the length of time required prohibited this as a production method. Cylinders of this type were tested on both single-cylinder and full scale engines, and were found to have cooling characteristics greatly superior to those with integrally formed steel fins. Furthermore, the weight of such cylinders was unchanged despite an increase of over 80 per cent in cooling area. Tool life, however, was so short that the method had to be ruled out in the interests of high production.

This difficulty in producing the grooves led to the idea of using a wider groove to accommodate two fins at a time, and from this was developed the so-called "U" fin. The spiral groove was made to a width of 0.115 in., and a shallow vee notch was formed at the center of the land. Pressure applied by means of a roller in this notch distorted the lands to form a dovetail. The fins were made from 0.025 in. thick sheet aluminum rolled into the form of a letter "U" and fed into the groove as before. A soft aluminum wire was then inserted at the bottom of the "U" and caulked down, forcing the fins into close contact with the sides of the lands and producing a positive lock. Tests run with these fins were eminently satisfactory and showed a substantial gain in cooling capacity over integral steel fins. Moreover, the design was capable of considerable flexibility, since it permitted a wide range of fin heights to be employed.

Some difficulties, however, remained. The use of wire for caulking gave some trouble, and the production of the spiral groove was necessarily a somewhat lengthy operation. Fins damaged in handling or in service were not readily replaceable, and some form of inter-fin support was required. These objections were all overcome by the introduction of the so-called "W" fin developed by the Bronander Engineering and Research Corp., and now in use on several models of Wright engines.

This new fin is fabricated from 0.025 in. dead soft aluminum strip (AMS 4001) containing only one per cent of impurities, and thus possessing excellent corrosion resistant and heat conducting properties. It is produced by progressively rolling the strip into the form of an exaggerated letter "W," with the two outside legs one in. or more in height and the center portion only 0.125 in. high. As the formed strip leaves the rollers, it is coiled onto a drum which has the same outside diameter as the root of the cylinder barrel grooves. When the drum is full the coil is removed and placed on a special Scandia machine which automatically cuts it into accurate half circles and stacks these on a carrier for inspection. (Fig. 1).

The manufacture of the cylinder barrel itself follows exactly the same procedure as has been used for many years in the fabrication of the integral steel fin barrel, except, of course, for the actual fin cutting operation, and it is thus possible to make use of virtually all of the existing production equipment. By a simple change in tooling, the Fay automatic lathes originally used for cutting the 46 fins in the steel are now employed to cut 30 concentric grooves (Fig. 2). These have a width of 0.116-0.119 in. and a depth of 0.125 in., with a 0.125 in. radius at the root blending into the straight sides with a 0.015 in. radius. The machining time for these relatively wide, shallow grooves is less than one-third of that required for the narrow, 0.625 in. deep steel fins. The next operation consists of rolling the lands to form a dovetail in the grooves and at the same time produce a radius on the edge to prevent cutting the aluminum when the fin is inserted. This was first done on a Fay automatic lathe, but more recently a Read thread rolling machine has been adapted to the job. The barrel is

(*Turn to page* 124, *please*)

performance measured in Millionths

In more than 40 Army and Navy applications, American Bosch Diesel Fuel Injection Equipment has served in the tasks of war. Today, Diesel Engines turn to the tasks of peace.

In American Bosch Fuel Injection Pumps, tolerances are often measured in millionths of an inch . . . thirty-nine millionths, for instance, between the cylinder wall and the plunger of the pump.

In the picture, an American Bosch craftsman is performing a vital grinding operation on the plunger. This is just one of the several critical operations on this same part . . . critical because the accurate metering of fuel is involved.

Such craftsmanship is traditional at American Bosch. Teamed with engineering experience which guides it, it continues to draw most of the nation's Diesel engine builders to Springfield for their fuel injection requirements.

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dropped over an expanding arbor, and the three sets of rollers feed inward to a predetermined stop to produce the desired form. The rollers are staggered so that only one is used for each groove. As a final operation, the barrels are cadmium plated on the outside to prevent corrosion.

After the cylinder head has been screwed and shrunk on to the barrel the fins are assembled on a special machine designed by Wright engineers. The individual fins are inserted into two sets of magazine blocks by four girls working on opposite sides of a bench at the end of which the assembling machine is located. (Fig. 3). Spacing of the fins is controlled by means of narrow steel blades fitting between the legs of the "W," each of which has three small projections to serve as staking punches. The right and left hand halves of the evenly numbered fins are loaded into one pair of blocks, while the odd numbered fins are placed in the other pair. Counting from the top, the first 23 fins are of equal height, namely, one in., but the remaining seven are only 0.750 in. high, since these are later machined down to a taper for wrench clearance. One pair of loaded blocks is inserted into special holders connected to the pistons of two diametrically opposed hydraulic cylinders, and the barrel is placed over an expanding arbor, locating on one of the flange holes (Fig. 4). As the operating foot pedal is tripped, the arbor expands to hold the work, and the two blocks move inwards to press the fins into their corresponding grooves and stake them lightly at three points. The blocks are then withdrawn and replaced by the second set, and the cylinder is indexed 90 deg. A cam on the index plate moves the cylinder outward to bring the empty grooves in line with the new set of fins.

A specially designed machine is now employed to caulk the fin firmly into place (Fig. 5). The assembly is placed on a rotating arbor, and a set of spacers is engaged in the inter-fin spaces. These serve to straighten out any fins that may be slightly distorted, and prevent the caulking blades from catching on the edges. Thirty steel blades are held in a magazine and are fed through a guide, one at a time until they engaged a grooved steel pressure roller located directly below the cylinder. The rotation of the cylinder thus feeds the blade out of the magazine and discharges it into a receiving magazine at the opposite side. This ac-

(*Turn to page* 126, *please*)

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Kiekhaefer had the necessary specialized experience in lightweight, 2-cycle engine design to produce such engines. Then, too, Kiekhaefer Engineers are not bound by tradition. They have an ardent zeal for blazing new paths over uncharted territory. They have a passion for precision and the courageous determination to reach for perfection.

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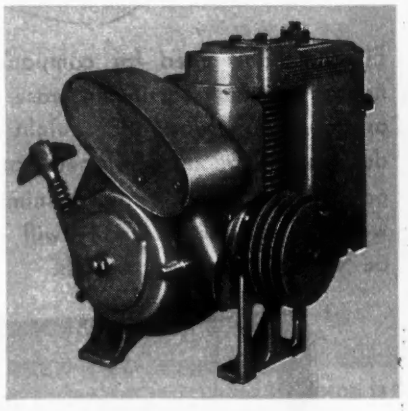

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tion caulks down the central portion of the "W" into virtually a solid mass, completely filling the groove in the barrel and forming a secure lock.

After finning, the assemblies are moved to a Lehmann Hydrotrol lathe equipped with a form tool wide enough to span the entire length of the barrel (Fig. 6). A cut is taken across the entire outside diameter of the fins. From the top 20 approximately 0.062 in. of stock is removed, but from this point down, the depth of cut increases until the height of the bottom fin is only 0.375 in. This clearance cut reduces the cooling area to some extent, but this is not of great importance, since there is considerably less heat to be dissipated near the cylinder base. The tool is carbide tipped, and the cutting is done dry, with a jet of compressed air serving to cool the tool and blow away the chips from the cut so as to avoid marring the fins. This operation serves the additional purpose of acting as a check on the tightness of the fins in their grooves, as any improperly caulked fin will be pulled out by the action of the tool. Burrs are removed on a speed lathe by means of a wire brush and abrasive cloth, after which the assemblies are passed to a second caulking machine where each fin is re-caulked as an additional precaution toward greater safety.

The final operation consists of crimping the fins for stiffening purposes and to hold the spacing. The barrel is placed on an arbor on a small hydraulic press and located so that the split between one set of fins is uppermost (Fig. 7). By means of a lever on each side of the machine, a set of guides is inserted between each fin, and a third set brought down from the top. The pedal is then tripped and the ram descends. The top fin of each pair is crimped down for a distance of 0.250 in. until it touches the top of the second fin at a distance of 0.500 in. from the center line on each side. The lower fin is similarly crimped down to touch the top of the next lower fin at a distance of one in. on each side of the center. The cylinder is then indexed 90 deg and the operation repeated until four sets of crimps have been made. The lower six fins are not crimped, since their lack of height assures adequate stiffness.

An additional advantage gained through the use of these aluminum fins has been a reduction in the overall weight of the engine. Although this amounts to only one lb per cylinder, it represents 72 lb on a four-engine Superfortress. Furthermore, the adoption of these fins makes possible the use of a barrel forging having a wall thickness of only 0.50 in. as against the 1.0 in. required for the integral steel fin type. This has effected a saving of some 24,000,000 lb of highly critical alloy steel in a year. The increased depth of fin, coupled with the fact that 60 fins are installed in the space formerly occupied by 46, has resulted in an increase in cooling area of more than 55 per cent, and in consequence cylinder barrel temperatures under normal operating conditions are running from 60 to 100 deg lower than with steel fins. Due to the method of construction, the "W" fin has 50 per cent more contact area with the steel barrel than is possible with the sleeve or "muff" type, and so tightly is it caulked into place that there is no appreciable loss of conductivity due to the presence of air pockets. Should future developments make it necessary, the depth of the fins may be increased to a degree limited only by the spacing between the cylinders.

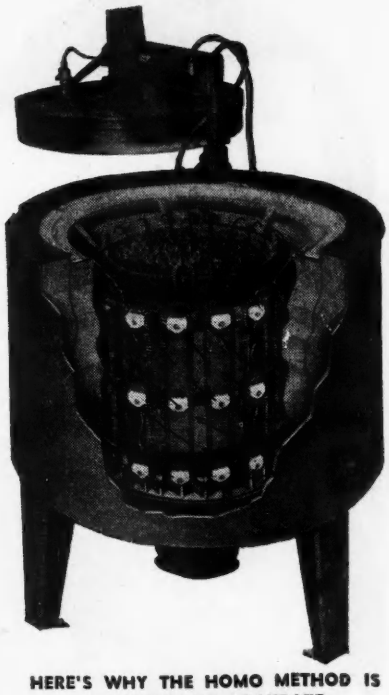
From the service point of view, the aluminum fin offers another advantage in that, if damaged either by careless handling or as the result of a crash, it may be straightened by hand without danger of cracking, a feature not possible with either steel fins or cast aluminum muffs. Test cylinders have been heated to 500 F and cooled to 50 F below zero, and it has required a direct pull of between 700 and 800 lb to remove the fins. To remove them for replacement purposes a cut is made through the root of the fin, and this can then be lifted out without difficulty.

Airplane engine forgings are tempered by Billings & Spencer, Hartford, Conn., in this Homo Method Tempering Furnace. This is one of hundreds of installations now used in aircraft production.

How the HOMO METHOD Gives 100% Control of TEMPERING

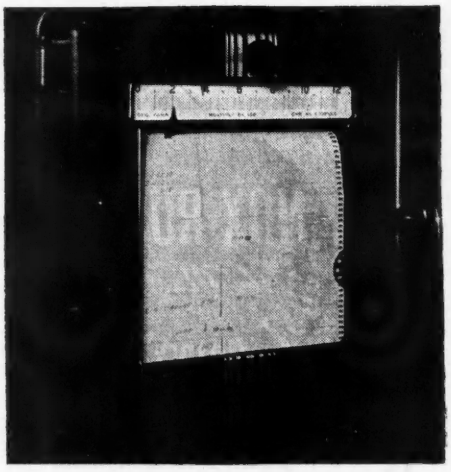
The Maintenance Base's need for accurate, fully-automatic tempering is met by the Homo Method, with these specific features:

1. Homo heats accurately and uniformly. It pioneered air-drawing with electric heat and forced-convection, as the way to raise the standards of quality in tempering. And the modern Homo equipment's success is shown by its use in factory heat-treatment of engine parts, airplane parts and propeller parts, throughout the industry.
2. Homo is flexible. It comes up to temperature quickly; can be used in rapid succession on jobs of widely differing temperatures.
3. Homo is fully-automatic. Its Micromax Controller handles the heating and holding cycles, as directed, without supervision.
4. Homo is safe, clean, easy to use.
5. Homo is easy to install. The Control Panel reaches you wired and ready to connect to Furnace and power line; the Furnace is as completely assembled as shipping and handling requirements permit.
6. Homo is outstandingly dependable and strong. It is built to be always ready for work; always ready to work hard and continuously; to require the very minimum of attention. It's a fine job of equipment-building.
7. Homo is available in many sizes. If you have a tempering problem, ask an L&N engineer to talk it over with you, or to send a copy of Catalog T-625; as you prefer.



HERE'S WHY THE HOMO METHOD IS UNIFORM AND ACCURATE

The unique air-circulation inside a Homo (the name comes from "homogeneous tempering") Method Furnace. Forced by an alloy fan in the base of the Furnace, air swirls past the electric heaters and pours uniformly through the load—even, when, as shown here, the load is densely-packed nuts. Circulation is so rapid and direct that the temperatures of heater and work draw together with remarkable speed, as heating proceeds, and when the soak point is reached conditions throughout the furnace become homogeneous, and remain so during the entire soak. There is no overshooting of the soak temperature; no falling away; temperature is held on the line by the Micromax Controller.



HERE'S WHY THE HOMO METHOD IS CONTROLLED AUTOMATICALLY AND DEPENDABLY

Typical Micromax Controller chart of a busy Homo Tempering Furnace. Note how heat-treater marks each record; identifies his work and shows how he followed orders.

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Two-Way Hydraulic Shock Absorbers for Freight Cars

Railroad freight cars that "ride" like Pullmans, cutting losses in merchandise in transit, reducing wear and maintenance on the cars themselves, and even eliminating much damage to tracks and road beds caused by the shock of passing trains, will be in operation in the not too distant future.

This is revealed in an announcement by the Monroe Auto Equipment Company, Monroe, Mich., that direct action two-way hydraulic shock absorbers for freight cars now are well past the experimental stage and are being thoroughly tested on refrigerator and tank cars with excellent results.

The freight car shock absorbers are similar in design and type of mounting to those used on new streamliners and other passenger equipment.

Tests so far are said to have shown that the two-way hydraulics, in cutting "bottoming" to a minimum and controlling rebound as well, will solve many of the problems arising from increased freight train speed. With rail freight equipment being pushed to the limit of usefulness because of wartime demands, these problems have been emphasized to a greater extent than ever before.

Page Steel and Wire Div. Opens New Sales Office

Page Steel and Wire Division of American Chain & Cable Co., Inc., has established a new sales office in the General Motors Building, Detroit, Mich. E. B. Brant and W. R. Stephens, formerly at the Page plant at Monessen, Pa., will make their headquarters in the Detroit office.

Classified Advertisements